# WSH Guidelines

# Healthcare

## Contents

# 1 Introduction

The global healthcare landscape is changing rapidly. Longer life expectancy, ageing population, explosion of chronic diseases and ravage of Covid-19 are fuelling change and raising healthcare demands and challenges. The world has seen change fundamentally and so has the healthcare ecosystem.

Singapore's healthcare system has also been put to the test since the Covid-19 outbreak in 2020. New imperatives have emerged and radicalised changes in healthcare delivery, treatment, and management. The pandemic has accelerated the adoption of various digital health technologies and move towards telehealth solutions. The ongoing management of chronic conditions, providing care to the critically ill and preventive health strategies are also as important as ever.

The transformation of healthcare is possible only with sustainable human capital – the healthcare workforce. And of paramount importance is the health, safety, and wellbeing of healthcare professionals and workers. As front liners, they are exposed to a wide array of workplace and work-related hazards that can adversely affect their health and safety. Long hours, shift work, workplace aggression and infectious diseases are some common hazards that are putting healthcare workers at risk for illness and injury.

A safe and healthy work environment can boost the wellbeing, morale, and productivity of these employees. Poor Workplace Safety and Health (WSH) practices can contribute to illness, absenteeism, productivity loss, disability, and even death. The WSH Act covers all workplaces, including healthcare facilities, and all stakeholders must take reasonably practicable measures to ensure the safety, health, and wellbeing of every individual.

Recognising the above, this set of guidelines was developed to share and promulgate good industry practices among the various healthcare settings in Singapore. The guidelines provide information on common WSH hazards faced by healthcare employees in their work and practicable measures to mitigate the associated risks. The guidelines also highlight the importance of a robust healthcare management system, which has become critical and essential especially in the dawn of Covid-19 and possible future pandemics.

## 2 Legal and Relevant Requirements

The organisation should identify the key legal requirements that are applicable to its activities, products and services. To ensure compliance, the organisation should establish, implement, and maintain procedures to identify and provide access to all applicable laws, codes of practice, standards, and guidelines. Such information and other requirements should be kept up-to-date and be communicated to all relevant parties and persons working in the organisation.

Table 1 lists some examples of the regulatory requirements that an organisation should seek to understand and comply. The list is non-exhaustive, and organisations should proactively identify other relevant regulatory requirements that are applicable to their organisations.

Table 1: Examples of regulatory requirements.

| **Regulatory Requirement** | **Agency/ Authority** | **Brief Description** |
|---|---|---|
| Workplace Safety and Health (WSH) | Ministry of Manpower (MOM) | The WSH Act and its subsidiary legislations cover safety and health at the workplace. It requires stakeholders to take reasonably practicable measures to ensure the safety and health of workers and other people who are affected by the work being carried out. |
| Workplace Injury Compensation | MOM | The Work Injury Compensation Act makes provisions for compensation to employees for injury or illness suffered in the course of their employment. |
| Radiation Protection | National Environment Agency (NEA) | The Radiation Protection Act and its subsidiary Regulations makes provisions for the control and regulation of the import, export, manufacture, sale, disposal, transport, storage, possession and use of radioactive materials and irradiating apparatus. It also provides for a system to impose and maintain nuclear safeguards for the implementation of the |

| | | |
|---|---|---|
| | | Convention on the Physical Protection of Nuclear Material. |
| Environmental Protection and Management | National Environment Agency (NEA) | The Environmental Protection and Management Act and its subsidiary legislations cover the protection and management of the environment and resource conservation, including management of hazardous substances. |
| Fire Safety, Emergency Preparedness and Response | Singapore Civil Defence Force | The Fire Safety Act and its subsidiary legislations cover protection of persons and property against fire, and emergency response and preparedness. |

In addition to regulatory requirements, Approved Codes of Practice (ACOPs) are set out in the WSH (Approved Codes of Practice) Notification. These ACOPs provide practical guidance with respect to the requirements of the WSH Act relating to safety, health, and welfare at work. Organisations should identify and adopt the relevant ACOPs that are applicable to them, and if not, other documents that are deemed equivalent to or above the standards prescribed in these ACOPs.

**Incident Reporting**

Employers and/or occupiers are required to report work-related accidents, workplace accidents, dangerous occurrences and occupational diseases to the MOM within 10 days of an accident or diagnosis, under the WSH (Incident Reporting) Regulations.

In addition, doctors or dentists who diagnose an occupational disease, must also report such cases to the MOM within 10 days of making the diagnosis.

For more information on the types of incident that need reporting, refer to the MOM website.

**Risk Management**

Under the WSH (Risk Management) Regulations, Risk Assessments (RA) must be conducted to address the safety and health risks posed to any person who may be affected by the activities in the workplace, prior to work commencement.

RA allows stakeholders to identify hazards at the workplace and implement effective risk control measures to prevent the unsafe work conditions from escalating into accidents, injuries and occupational diseases.

To learn more about risk management, refer to Chapter 4 on Workplace Safety and Health Risk Management.

## 3 Roles and Responsibilities

Every staff member in a healthcare institution should have clarity on their assumed roles and related responsibilities including considerations for WSH. The following table provides some roles that are common across healthcare settings and their responsibilities (non-exhaustive):

Table 2: Roles and responsibilities in healthcare settings.

| Roles | Responsibilities |
|---|---|
| Employer/ Occupier | • Ensure the safety and health for everyone within the premises even if the person is not an employee (e.g., contractors, outsourced staff).<br>• Ensure staff emotional, mental, social and physical wellbeing.<br>• Provide a safe (working) environment for employees and visitors.<br>• Ensure that risk assessments are conducted for all work activities in the workplace.<br>• Ensure employees are provided with sufficient instruction, training and supervision so that they can work safely.<br>• Ensure that employees are provided with appropriate Personal Protective Equipment (PPE) and mask fitted.<br>• Ensure that fire safety provisions and requirements are met. E.g., regular fire drills, fire safety orientation for new staff.<br>• Make sure that adequate safety and health measures are taken for any machinery, equipment, plant, article or process used at the workplace.<br>• Establish emergency preparedness and response procedures.<br>• Vaccinate employees at prescribed intervals (as well as for new staff before they start employment), especially those who are at higher risk of exposure or susceptibility to bloodborne and airborne pathogens.<br>• Ensure infection control measures are strictly in place especially during pandemics.<br>• Implement a surveillance and reporting system to track and monitor work(related) incidents. |
| Employee | • Adhere to WSH rules and regulations.<br>• Take charge of personal safety, health and wellbeing and refrain from engaging in acts that may endanger themselves or co-workers.<br>• Use PPE provided properly and do not tamper with or misuse the equipment. |

| | |
|---|---|
| | • Report any incident, near miss, hazard or dangerous occurrence to immediate supervisor.<br>• Ensure that the required vaccinations are taken per individual workplace guidelines.<br>• Attend relevant health and safety trainings.<br>• Adhere to infection control measures. |
| Manager | • Ensure that RA is conducted, and risk control measures are implemented before any work activity commences.<br>• Maintain oversight of work activities and manage associated hazards and risks. |
| Human Resource Manager | • Support employer in:<br>o Ensuring that a robust recruitment process is in place to choose suitable job candidates who are able to meet position requirement and WSH obligations.<br>o Ensuring job descriptions and responsibilities (including safety and health) are effectively communicated to all employees.<br>o Providing WSH training to equip staff with the relevant knowledge and skills to be competent in their roles.<br>o Ensuring that recommended pre-employment vaccinations and health screenings are done for all new employees, according to their job requirements.<br>o Ensuring that employee orientation programmes include WSH and fire safety modules.<br>o Conducting regular health screening exercises to detect health issues early in staff so that appropriate and early interventions is possible.<br>o Making available the necessary support, measures and programmes in ensuring staff emotional, mental, social and physical wellbeing. |
| Risk Management (RM) and Risk Assessment (RA) Leaders | • Work with team leaders and their staff to identify workplace and work-related hazards and put in place measures to control the risks.<br>• Provide regular WSH updates to employer, preferably monthly.<br>• Review WSH risk register and update when necessary. |

| | |
|---|---|
| | • Ensure a training matrix and/or programmes are available to educate staff on WSH hazards, risks and controls. |
| Contractors / Suppliers | • Work with RM and/or RA Leaders to conduct RA when necessary.<br>• Submit RA forms to company's person-in-charge (for review). |

# 4 Workplace Safety and Health Risk Management

## Risk Management

Risk Management (RM) is a systematic way to identify, assess, control, and monitor WSH risks associated with any work activity or trade. The main components of the RM process are:

- Preparation.
- Risk Assessment (RA).
- Risk Control Implementation.
- Record-keeping.
- Review.

## Preparation

The employer should appoint an RM team to take charge of the overall RM direction and activities of the workplace. The team must be multi-disciplinary and has thorough knowledge of the work to be assessed.

The extent of the RA should be scoped, and the relevant information gathered before conducting the RA.

## Risk Assessment

Conducting RA and implementing risk control measures are requirements under the WSH (Risk Management) Regulations.

RA shall be carried out and risk control measures implemented before the start of any work activity.

The employer or principal shall conduct a RA on WSH risks, including mental well-being, associated with any activity or exposure in the workplace. Considerations for preparedness for terrorism threats and disease outbreaks at the workplace should also be included.

RA should be conducted in consultation with relevant stakeholders (e.g., contractors, suppliers) as much as possible.

RA can be conducted in three simple steps, namely, Hazard Identification, Risk Evaluation and Risk Control. These steps are elaborated in Figure 1 below.

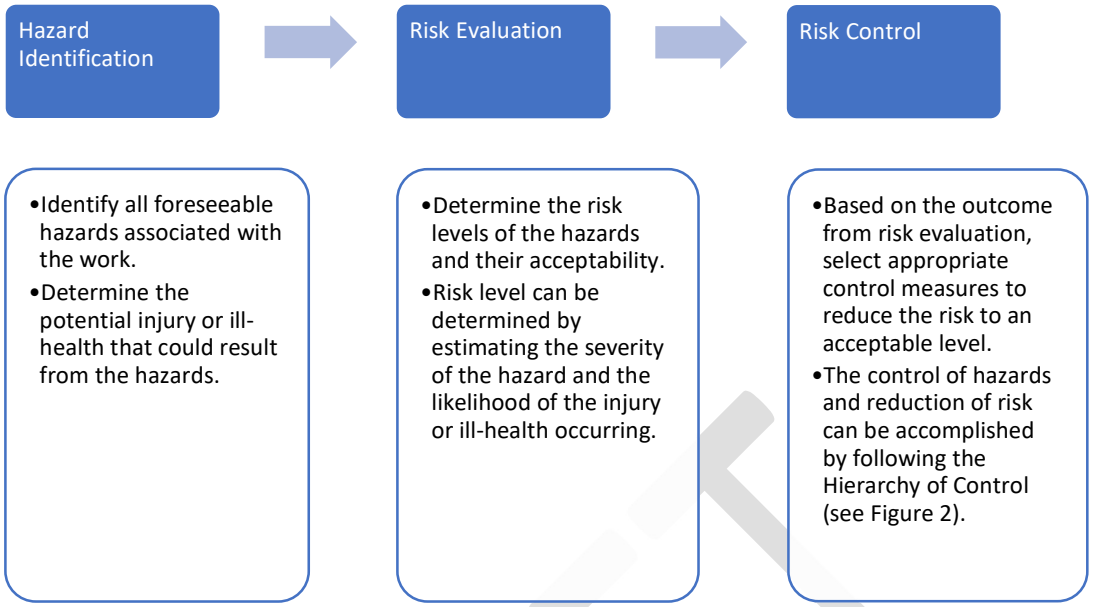


Figure 1: RA methodology.

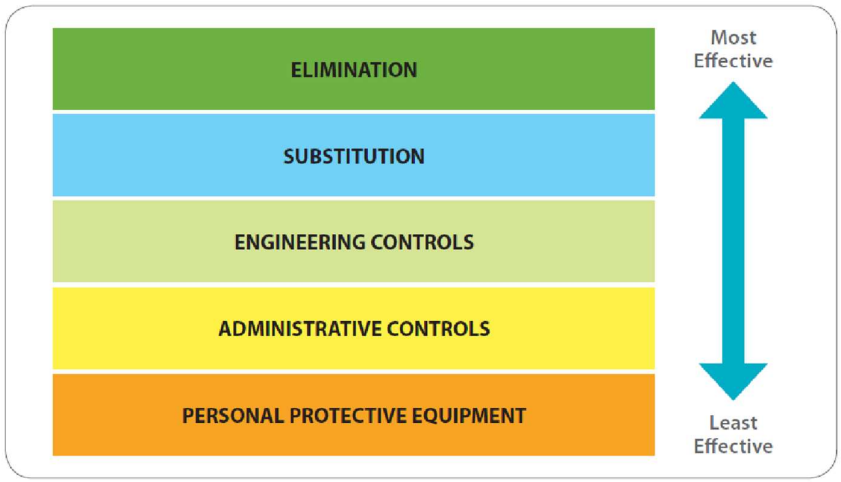


Figure 2: The Hierarchy of Control.

**Risk Control Implementation**

The employer or manager should implement the risk control measures as soon as possible. To facilitate this, an action plan can be prepared, which includes the implementation timeline and persons responsible for implementing the measures.

All persons exposed to the risks must be informed of the nature of the risks involved and any measure or Safe Work Procedure (SWP) implemented.

Regular inspections or audits should be conducted by qualified personnel to make sure that risk control measures have been implemented and practised, effectively.

**Record-Keeping**

RA records, including but not limited to RA forms and control measures records, should be kept for at least three years from the RA approval date.

**Review**

Review and, if necessary, revise the RA:

- At least once every three years from the RA approval date; or
- Upon the occurrence of any bodily injury to any person because of exposure to a hazard in the workplace; or
- When there is any significant change in work practices or procedures; or
- Where there is any significant change in the employee's personal health (including mental well-being) in relation to safety critical work process or activity; or
- When new information on WSH emerging risk, threat of terrorism, disease outbreak, or mental well-being is made known.

**Communication**

Communication is a constant aspect throughout the RM process.

All persons at the workplace should be informed of the risks they face and the control measures to manage those risks.

To learn more about RM, refer to the WSH Council's Code of Practice on Workplace Safety and Health Risk Management.

# 5 Hazards in the Healthcare Environment

The range of workplace hazards that exist in healthcare facilities can vary and is dependent on the size and range of medical services provided. This chapter focuses on both common healthcare hazards (e.g., ergonomic risk factors, slips, trips and falls, and sharps) and hazards that are specific to certain medical services (e.g., mercury waste from amalgam removal, exposure to anaesthetic gases and chemotherapeutic agents).

The following sections describe the different types of hazards in detail.

## 5.1 Chemical Hazards

Chemicals exist in different forms and they can elicit varying toxic responses on the human body from mild irritations to potentially serious or even fatal damage to body tissues and organs. Many factors can influence the risk of human exposure to chemicals used in healthcare facilities and these include:

- Toxicity and physical properties of substances used;
- Nature and duration of exposure;
- Routes of entry into the human body;
- Aggregated effects of combined exposures;
- Work practices; and
- Susceptibility of the individual.

### 5.1.1 Management of Hazardous Chemicals Programme

Where hazardous chemicals are used, handled or produced, a management programme should be established and implemented to safeguard the safety and health of persons who are liable to be exposed to these chemicals. The Management of Hazardous Chemicals Programme (MHCP) should form part of the overall WSH management system of the facility. The MHCP must cover the safety and health aspects throughout the life cycle of the hazardous chemicals that are used or produced, from transportation and storage to handling, use and disposal. The programme should include the objectives, targets, recordkeeping process and written SWPs.

The facility which uses or handles any hazardous chemical may choose to implement the relevant elements or components of the MHCP depending on the nature of its work, operation or process carried out, and the hazardous chemical(s) used or handled. As a minimum, the programme should have:

- A management policy that states the responsibility and commitment of management in protecting employees from exposure to hazardous chemicals. This policy should be communicated to all employees. Specific policies on chemical exposure for pregnant and lactating employees should also be covered.
- Risk assessment that covers hazard identification and risk control.

- Hazard communication through Safety Data Sheets (SDS) and chemical labelling. Facilities are required to adopt the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) for SDS and product labels for the chemicals used.

### 5.1.2 Waste Anaesthetic Gases and Vapours

Uses

Anaesthetic gases are used to provide inhalation anaesthesia in adults and children undergoing surgery, dental and obstetric procedures. The common agents used are nitrous oxide and halogenated agents such as isoflurane, desflurane, sevoflurane, enflurane and halothane. Healthcare workers can be exposed to Waste Anaesthetic Gases (WAGs) when they leak out from various sections of the anaesthetic circuits or when patients in the recovery room exhale the gases into the air.

Effects of Exposure

Exposure to high levels of WAGs may occur with the use of unscavenged systems and/or poor general ventilation. Common symptoms of exposure include effects on the central nervous system such as mood disorders, headaches, fatigue and impaired neuropsychological performance. Though rare, occupational diseases such as hepatitis due to halothane, bronchial asthma due to enflurane and allergic contact eczema due to halothane or isoflurane can occur.

Locations Used/Found

Healthcare workers can be exposed to WAGs and vapours in:

- Operating rooms;
- Recovery rooms (post anaesthesia care units);
- Intensive care units;
- Obstetric delivery rooms; and
- Dental facilities.

Exposures can be higher in paediatric surgery, otorhinolaryngologic (ENT) surgery and dental surgery. In ENT and dental surgery, the close proximity of the surgeon and attendant staff to the patient's mouth results in increased exposure to the exhaled anaesthetic vapours. Levels of WAGs are higher when mask anaesthesia is used and the mask does not fit the patient properly.

Workers at Risk

- Anaesthetists;
- Anaesthetic nurses and assistants;
- Post anaesthesia care nurses and staff;
- Surgeons and surgical staff;
- Dentists;
- Dental nurses, assistants and attendant staff;
- Recovery room nurses and other staff;
- Delivery room staff such as obstetric nurses;
- Medical technicians;

- Operating room personnel;
- Emergency room staff; and
- Radiology department personnel.

Routes of Exposure and Sources of Leaks

The main route of exposure is through inhalation. In operating theatres, the main sources of leaks include:

- Tank valves;
- High and low-pressure machine connections;
- Connections in the breathing circuit;
- Defects in rubber and plastic tubing;
- Hoses;
- Reservoir bags;
- Ventilator bellows; and
- Y-connectors.

In addition, selected anaesthesia techniques and improper practices can also contribute to the escape of WAGs into the atmosphere of the operating room such as:

- Leaving gas flow control valves open;
- Leaving vaporisers on after use;
- Spillage of liquid inhaled anaesthetics;
- Poorly fitted patient face masks; and
- Improperly inflated tracheal tube and laryngeal mask airway cuffs.

In recovery rooms, obstetric and dental facilities, the main source of WAGs is from the vapours contained in the air that patients exhale.

Management of Waste Anaesthetic Gases

Anaesthetic gases are widely used in healthcare facilities such as obstetrics departments, operating theatres and dental facilities. As there is a potential for side effects on the neurological and reproductive systems with excessive exposure, a management system should be in place to ensure that employees are protected.

Risk Assessment

Areas where anaesthetic gases are used or could be present should be identified and documented. Employees at increased risk for exposure to WAGs should also be identified.

Exposure to WAGs can be quantified by various means including:

- Measuring airborne concentrations of WAGs;
- Identifying sources of leaking; and
- Personal sampling measurements of exposed staff.

Control Measures

The control of exposure to WAGs should follow the hierarchy of controls. The use of engineering controls is preferred, followed by safe work practices as the reduction of the hazard at source is generally the most effective.

Engineering Control Measures

*Scavenging system*

An effective system to collect and dispose of anaesthetic gases in both operating and non-operating theatre settings must be put in place. WAGs should be exhausted to the outside atmosphere. In the operating theatre, an active scavenging system attached to the site of overflow in the breathing circuit with a minimum flow rate of 40 l/min is an effective method of reducing exposure to WAGs. The presence of a volumetric buffer regulation system is preferred.

All gases in the anaesthetic system should be channelled to the exhaust and then to the scavenging system.

*Reduction of leakages*

The amount of leakage in anaesthetic machines should be reduced to as low as practically possible. Where possible, an automatic leakage detector should be installed; otherwise, regular tests for leaks should be performed and the results documented and necessary actions are being taken.

*General ventilation*

There should be adequate ventilation in the operating theatres or other rooms where anaesthetic gases are used to ensure there is additional dilution ventilation of the WAGs. The rate of air change should be more than 15 air changes per hour or as stipulated by national regulations.

Safe Work Practices

*Anaesthetic practices*

Exposure to high levels of anaesthetic gases can occur during the induction and emergent phases of anaesthesia.

*Preparation of anaesthesia*

- An anaesthesia system should be chosen to minimise leakage and allow active scavenging of WAGs.
- Use of a low flow or minimum flow system for fresh gas is preferred.
- Before anaesthesia is administered, a complete inspection of the anaesthesia apparatus should be done daily before the commencement of the first case and an abbreviated check before every case.
- Face masks should be properly fitted and sealed to minimise leakage.
- Face masks should only be used if laryngeal or tracheal tubes cannot be used.
- If tracheal tubes, laryngeal masks and other airway devices are used, they should be positioned properly with the cuffs inflated adequately.
- For intubation without a cuff, choose a tube size that induces minimum leakage.

*Induction of anaesthesia*

- Exposure to WAGs can be reduced by using either intravenous induction or a double mask system.

- Check that the scavenging device is correctly connected before each patient is anaesthetised or whenever the apparatus is moved.
- Start using the scavenging system during the induction phase of the anaesthesia.
- Turn on the supply of the anaesthetic gases after the face mask is placed properly or after the tube is connected to the patient system.

*Maintenance of anaesthesia*

- In mask anaesthesia, the effectiveness of the seal of the mask should be checked constantly.
- When patient is disconnected from the breathing system, the exhaust valve should be opened while the open end should be closed. Alternatively, the gas supply should be cut off briefly and the anaesthetic gases in the buffer balloon is emptied via the scavenging system.

*Emergence from anaesthesia*

- Before removal of the mask or tube, oxygen should be administered at the end of the anaesthesia at a high flow rate to flush any anaesthetics out of the anaesthesia system and the patient's lungs.
- The flushed out anaesthetic gases should be removed by the scavenging system.
- The supply of anaesthetic gases should be turned off at the end of the anaesthesia.

*Filling of vaporisers*

- Handling of anaesthetics such as filling of vaporisers should not be done in the recovery room.
- Use safety devices when filling vaporisers to minimise the opportunity for spills of volatile anaesthetic agents.
- Vaporisers should be filled in a well-ventilated area. Use of a closed system for filling of vaporisers is preferred.
- Routine procedures for detection of leaks should be present.

Maintenance Programme

There should be a regular preventive maintenance programme for the following equipment carried out by trained individuals.

- Anaesthetic apparatus, hoses, connections, reservoir bags, etc.;
- Wall plugs;
- Anaesthetic gas piping;
- Anaesthetic gas scavenging systems; and
- Ventilation systems.

During maintenance, points to note are:

- Care should be taken to assemble the equipment properly;
- Connectors should be close-fitting, gas-specific and appropriate to the specific anaesthetic equipment;
- Parts that are damaged or of inferior design should be replaced;
- Regular checks for the proper functioning of the scavenging system should be in place; and

- Records of maintenance should be kept.

In addition, there should be an established, written maintenance plan and scheduling of maintenance for the various components of the air-conditioning and exhausting systems.

Administrative Measures

*Record-keeping*

The following records should be adequately kept:

- Types of anaesthesia apparatus and volatile agents in use;
- Daily inspections of apparatus and scavenging systems in use;
- Written work instructions for proper use of anaesthetic apparatus, scavenging systems, procedures for filling of vaporisers, spill or leak management, safe work practices and maintenance of apparatus;
- Records of preventive maintenance and checks;
- Incident investigation reports;
- Action plans, if any;
- Monitoring records of WAGs, including workplace toxic substances monitoring results compared against Permissible Exposure Level of toxic substances listed in the Schedule of WSH (General Provisions) Regulations; and
- Medical surveillance results, if any.

*Training and education*

All staff handling or using volatile anaesthetic agents should be trained in the following aspects:

- Health effects of exposure to these agents;
- Rationale of engineering control measures;
- Proper use of anaesthetic equipment;
- Safe work practices;
- Use of appropriate PPE; and
- Management of spills or leaks.

The training should be updated whenever there is a change in equipment, processes or an incident occurs.

Personal Protective Equipment

PPE should not be used as a substitute for engineering control measures, safe work practices or administrative controls in protecting employees from exposure to WAGs. In the event of a spill, PPE should be used in conjunction with engineering measures, safe work practices and administrative controls to contain and clean up the spill. The choice of appropriate PPE such as chemical resistant gowns, gloves, goggles and respirators depends on the type of agents used. Always refer to the SDS of the agent for more information.

Management of Spills and Disposal of Liquid Anaesthetic Agents

Spills of small amounts of liquid anaesthetic agents would probably have evaporated at room temperature before a cleanup can be initiated. There should be a written procedure for the containment, clean up and disposal of large spills. Only adequately trained and equipped staff

should be allowed to respond to such spills. If you are unsure of the specific procedures and appropriate PPE, refer to the agent's SDS or consult the manufacturer.

General guidelines to help minimise exposure of employees to waste liquid anaesthetic agents are:

- Wear appropriate PPE such as chemical protective gowns, gloves, respirator and goggles;
- Ventilate the area where possible;
- Persons without PPE should not be present until the area is deemed safe by trained personnel;
- Collect spilt liquid and absorbent materials used and put in a tightly capped glass or plastic container. Seal and label the container; and
- Container should be handed over to a proper waste disposal contractor and should be disposed of according to national or international regulations.

Monitoring

*Monitoring exposure at the workplace*

Measuring the airborne levels of anaesthetic gases at the workplace is a method of evaluating workplace exposures. Different methods and types of measurements can be used. Choice of method and sampling strategy would depend on the objective of the sampling and staff are advised to consult technical experts and manuals for the appropriate method. Data obtained from the monitoring can be used to assess effectiveness of control measures so as to ensure the lowest levels of WAGs. These monitoring reports must be submitted to the MOM.

*Reporting and record-keeping*

There should be a reporting system in place so that staff exposed to WAGs can report incidents. Exposure records and biological tests of exposed staff should be properly kept and maintained. As WAGs may have effects on the reproductive system, the organisation should develop a policy regarding exposure of all staff particularly vulnerable workers such as those pregnant, lactating and planning for a pregnancy.

*Medical surveillance*

The organisation may want to put in place a surveillance programme for early detection of health effects from exposure to WAGs.

Recommended elements to be included in the programme are:

- Baseline or pre-placement medical questionnaire including:
    - A detailed occupational history;
    - Past exposure to WAGs;
    - Past medical history with emphasis on hepatic (liver), renal (kidney), neurological (nervous system), cardiovascular (heart and circulation) and reproductive functions;
    - Medical evaluation including history and physical examination; and
    - Suitable laboratory tests where applicable;
- Appropriate laboratory/biological tests if necessary;
- Reporting of health effects by employees;

- Incident reporting in the event there is exposure to high levels of anaesthetic agents such as spills or leaks;
- Reproductive hazards policy to address worker exposure and reproductive effects in both male and female employees;
- Final review if a worker requests for a job transfer or leaves the job;
- Maintenance of SDS for all anaesthetic agents in use;
- Exposure and medical records of employees who may be exposed to anaesthetic agents should be properly kept and maintained; and
- Information in the surveillance programme should be used to review working conditions and control measures.

Further information can be obtained from:

- US Occupational Safety and Health Administration (OSHA): Anesthetic Gases: Guidelines for Workplace Exposures
- Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (CDC, NIOSH): Waste Anesthetic Gases Occupational Hazards in Hospitals
- CDC, NIOSH: Control of Nitrous Oxide in Dental Operatories
- WSH Guidelines on the Management of Hazardous Chemicals Programme
- WSH (General Provisions) Regulations

### 5.1.3 Sterilising and Disinfecting Agents

Healthcare facilities use a variety of sterilising solutions to sterilise/disinfect a variety of heat-sensitive instruments, such as endoscopes, bronchoscopes, and dialysis equipment. These solutions may also be used as biological tissue fixative and as a component in X-ray film developers.

Common sterilising agents include glutaraldehyde, ortho-phthalaldehyde (OPA) and ethylene oxide.

<u>Glutaraldehyde</u>

Trade names of glutaraldehyde-based products include but are not limited to, Cidex®, Sonacide®, Sporicidin®, Hospex® and Omnicide®. Inhalation of vapours and aerosols can cause nose, throat and lung irritation. Respiratory sensitisation can cause allergic rhinitis and asthma-like reactions. In addition to causing respiratory effects, glutaraldehyde acts as a contact allergen, giving rise to contact dermatitis, usually on the hands but occasionally on the face. Individuals who become sensitised to glutaraldehyde can develop dermatitis after coming into contact with solutions containing as little as 0.1% glutaraldehyde. The permissible exposure limit for glutaraldehyde is 0.2 ppm[1] (short term).

<u>Ortho-Phthalaldehyde (OPA)</u>

OPA (Trade name Cidex® OPA) is a clear blue solution with little odour. It is a potential irritant that can cause stinging, excessive tearing, coughing and sneezing to the eyes, skin, nose and

[1] Parts per million

other tissues. It is a potential skin and respiratory sensitiser that may cause dermatitis. Staff who have prolonged or repeated contact may develop occupational asthma or pre-existing bronchitis or asthma may be aggravated. In addition, the product stains proteins on surfaces to grey/black.

Exposure to such sterilising solutions can occur during the following activities:

- Activating and pouring sterilising solution into or out of a cleaning container system (e.g. soaking basin in manual disinfecting operations and reservoir in automated processors);
- Opening the cleaning container system to immerse instruments to be disinfected;
- Agitating the sterilising solution;
- Handling of soaked instruments;
- Removing instruments from the container system;
- Rinsing the channels of instruments containing residual sterilising solution;
- Flushing out instrument parts with a syringe;
- Drying instrument interiors with compressed air;
- Performing maintenance procedures such as filter or hose changes on automated processors that have not been pre-rinsed with water;
- Cleaning up sterilising solution spills; and
- Aerosolisation of solution (e.g., with spray bottles to spray-wipe surfaces).

Table 3: Examples of control measures to reduce exposure (sterilising solutions).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Elimination / Substitution | • Substitute with a less hazardous chemical. |
| Engineering Controls | • Store soaking basins and processing units in enclosed areas.<br>• Provide local exhaust ventilation (e.g., laboratory hoods) for open soaking.<br>• Automate the transfer of sterilising solution from drums into process containers using pumps and closed transfer lines.<br>• Provide general dilution ventilation (10 air changes per hour, ANSI/AMMI 1996) for rooms where disinfection or sterilisation are carried out. |
| Safe Work Practices | • Ensure that all containers containing sterilising solution are covered at all times with tight-fitting lids. |
| Administrative Controls | • Provide eyewash stations in all areas where sterilising solutions are handled. |
| Personal Protective Equipment | • Use of PPE to prevent skin contact such as gloves (nitrile rubber gloves, butyl rubber gloves or 100% copolymer gloves may be used), sleeve protectors, safety eyewear and fluid-resistant gowns or aprons. |

Healthcare personnel who come into contact with these agents include those who work with cold sterilisation equipment (e.g. within endoscopy department and operating theatres, theatre sterile supply units (TSSU), central sterile supplies units (CSSU) and dental clinics).

CIDEX OPA: CIDEX OPA should be neutralised prior to disposal. Either glycine (free base), at the minimum rate of 33 g per 5 L of Cidex® OPA solution, or an approved neutralising agent may be used as a neutraliser. The minimum recommended neutralisation time for glycine is one hour.

For other approved neutralising agents, refer to the manufacturer's instructions on neutralisation time. Discard neutralised solution into drain. Flush drain thoroughly with water.

Further information can be obtained from:

- US OSHA: Best Practices for the Safe Use of Glutaraldehyde in Health Care
- Society of Gastroenterology Nurses and Associates, Inc. (SGNA): Guideline for Use of High Level Disinfectants & Sterilants for Reprocessing Flexible Gastrointestinal Endoscopes
- CDC, NIOSH: Glutaraldehyde – Occupational Hazards in Hospitals
- Occupational Safety and Health Service, Department of Labour, New Zealand: Guidelines for the Provision of Facilities and General Safety and Health in the Healthcare Industry
- SA Health: Guideline for the Safe Use of Ortho-phthalaldehyde (OPA)
- WSH Guidelines on the Management of Hazardous Chemicals Programme
- WSH (General Provisions) Regulations

<u>Ethylene Oxide</u>

Ethylene oxide (EtO) is commonly used as a sterilising agent for medical devices and equipment that are heat and moisture-sensitive and thus cannot be sterilised by steam. EtO is also a flammable gas with sweet odour and measures need to be taken to prevent fire and explosion involving EtO. High vapour concentrations of EtO (in the order of 1000 ppm) can cause irritation and damage to the eyes and upper respiratory system, hoarseness, cough, headache, nausea and recurrent vomiting, fatigue and pulmonary oedema. Less frequently reported effects include muscular weakness, abdominal discomfort and diarrhoea, and nervous system disorders. EtO liquid has the capacity to cause burns, blisters and dermatitis when it comes into contact with skin. EtO is toxic in various body systems. It is also a mutagen, an established animal carcinogen and a human carcinogen (International Agency for Research on Cancer (IARC), 2007) that may have adverse reproductive effects on humans. The permissible exposure limit for EtO is 1 ppm (long term).

Healthcare personnel who work in operating rooms, central supply, renal dialysis units, respiratory therapy departments and areas where EtO is used such as autoclaves will be prone to these hazards. The odour of EtO cannot be detected below approximately 700 ppm, therefore workers who are exposed to high concentration of this compound may not be aware.

Routes of exposure to EtO include:

- Inhalation of EtO gas in air;
- Skin, eye or mucous membrane contact with the liquid or with EtO absorbed in solid materials;
- Oral – residual EtO in ingested material; and

- Intravenous leaching of EtO from inadequately aerated medical devices inserted intravenously.

Table 4: Examples of control measures to reduce exposure (EtO).

| Control Approach | Examples of Control Measures |
|---|---|
| Engineering Controls | • Store supply cylinders in a ventilated enclosure (either a ventilated cabinet or a hood that covers the point where the cylinder is connected to the steriliser supply line).<br>• Keep the steriliser enclosed either in a mechanical access room or a cabinet, and the enclosure should be exhausted to a dedicated ventilation system.<br>• Cover floor drains with an anti-siphon air gap. The air gap, at the junction of the vacuum pump discharge line with the floor drain should be enclosed. Dedicated exhaust ventilation should be provided for the enclosures.<br>• Local exhaust ventilation sufficient to effectively remove EtO should be as close as possible to the top of the steriliser door.<br>• Provide appropriate local exhaust ventilation (e.g. laboratory hoods) for sterilisers using cartridges or glass ampoules.<br>• Provide general dilution ventilation for rooms where sterilisation is carried out.<br>• Provide real-time monitoring devices with audio and visual alarm for EtO sterilising facilities including the steriliser and exhaust ventilation systems and the environment where EtO is used. |
| Administrative Controls | • Access to steriliser rooms should be restricted.<br>• Install real time EtO monitoring in steriliser rooms where EtO is used or handled to monitor exposure.<br>• Develop a maintenance plan which includes regular checks of door gaskets, valves, tubing, and piping connections for all steriliser units.<br>• Store EtO in tightly closed cylinders or tanks in a cool, shaded, well ventilated area.<br>• Store EtO cylinders or tanks away from heat, sparks, flames, incompatible chemicals such as strong oxidisers, alkali, acids, and acetylide-forming metals such as copper, silver, mercury, and their alloys. |
| Personal Protective Equipment | • Provide proper PPE to prevent skin or inhalation exposures. |

Further information can be obtained from:

- CDC, NIOSH: Current Intelligence Bulletin 52: Ethylene Oxide Sterilizers in Health Care Facilities Engineering Controls and Work Practices
- WSH Guidelines on the Management of Hazardous Chemicals Programme
- WSH (General Provisions) Regulations
- Reference on storage: DHHS (NIOSH) Publication No. 2007–164 (https://www.cdc.gov/niosh/docs/2007-164/pdfs/2007-164.pdf)

Formaldehyde

Formaldehyde is a tissue sterilising agent and preservative often used in dialysis units, histopathology laboratories and operating theatres. It is often combined with methanol and water to make formalin. Formaldehyde exposure in the healthcare sector mainly occurs from the handling of specimens and the viewing of processed microscopy slides treated with formalin. Formaldehyde is both a dermal and respiratory sensitiser. Formaldehyde vapour can cause irritation to the eyes and the respiratory tract. In liquid or solution form, it can cause both primary irritation and sensitisation dermatitis and rarely, occupational asthma.

The International Agency for Research on Cancer (IARC) classifies formaldehyde as a human carcinogen, with the potential to cause upper respiratory tract cancer. The short-term permissible exposure level (STEL) of formaldehyde is 0.3 ppm (0.37mg/m3) and its Threshold Limit Value – Time-Weighted Average (TLV-TWA)[2] is 0.1 ppm (0.12mg/m3).

Healthcare personnel who are at risk include laboratory technicians, nurses, surgeons/dentists, histopathologists and pathologists etc., where formaldehyde is used, e.g. operating theatres, pathology laboratories or dialysis centres.

Table 5: Examples of control measures to reduce exposure (formaldehyde).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Provide local exhaust ventilation over workstations using formalin or specimens preserved in formalin. e.g., Grossing tables equipped with slotted fume hood, Downdraft tables, Biological Safety Cabinets (BSC) equipped with carbon filters.<br>• Ensure regular checks and maintenance for ventilation systems.<br>• Provide eyewash station in all areas where formalin is handled.<br>• Provide traps in floor drains. |
| Administrative Controls | • Install wall-mounted real-time formaldehyde monitoring device with set alarms in rooms where formalin / specimens treated in formalin are used/handled, to alert occupants when air level exceed STEL.<br>• Conduct regular hygiene monitoring for employees using/handling formalin or specimens treated in formalin to ensure that employees are not over exposed to levels beyond STEL and TLV-TWA.<br>• Provide regular refresher training on proper work practices.<br>• Ensure that the SDS for the chemical used is readily available to all workers. |
| Safe Work Practices | • Ensure that all containers containing formalin are covered at all times with tight-fitting lids.<br>• Purchase small quantities of formaldehyde in plastic containers for ease of handling and safety.<br>• Provide spill-absorbent bags for emergencies. |

| | |
|---|---|
| Personal Protective Equipment | • Use PPE to prevent skin contact such as respirators with organic vapour cartridges, gloves (nitrile rubber gloves, butyl rubber gloves or 100% copolymer gloves may be used), face shields, fluid resistant aprons and boots. |

5.1.4 Solvents

There is a wide range of solvents used in healthcare facilities such as medical laboratories' reagents, paints in equipment maintenance workshops, and cleaning agents for housekeeping and renovation works (e.g., xylene, toluene and alcohols). Most solvents can be absorbed through the skin or by inhalation and ingestion. Many solvents are central nervous system depressants and can cause headaches, dizziness, weakness, nausea and other symptoms. These solvents may also irritate the eyes, skin and upper respiratory tract. Prolonged contact may result in defatting and dehydration of the skin.

Long-term exposure to some solvents has been associated with cancer, adverse reproductive effects, cardiovascular problems, and damage to the liver, kidneys, central nervous system and hematopoietic system.

Healthcare personnel at risk include laboratory technicians, workshop technicians, contractors and housekeeping staff. Dentists, surgeons and their assistants can also be exposed to volatile organic compounds and solvents such as methacrylate and chloroform.

Monitoring
For personnel handling solvents, workplace toxic substances monitoring should be conducted regularly to determine workers' exposure to these solvents and assess the effectiveness of controls in reducing exposures in the work area. The monitoring report for these substances must be submitted to the MOM.

Personnel handling solvents and chemicals listed in the Schedule of the WSH (Medical Examinations) Regulations are required to undergo pre-placement and regular medical examinations to ensure fitness to work with such chemicals. These results complement the toxic substance monitoring in assessing workers' exposures and the effectiveness of controls. The results have to be submitted to the MOM.

Disposal
The solvent waste generated will need to be properly disposed according to NEA's toxic industrial waste requirements.

Table 6: Examples of control measures to reduce exposure (solvents).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Elimination / Substitution | • Substitute hazardous solvents with less hazardous alternatives. |
| Engineering Controls | • Provide local exhaust ventilation and enclosure of solvent vapour sources for controlling exposures to solvents in laboratories. |

| | |
|---|---|
| Administrative Controls | • Provide warning signs and labelling of solvent containers with information on the hazards of exposure to solvents and the precautions to take. |
| Personal Protective Equipment | • Use PPE to prevent skin contact and inhalation such as gloves, respirator (for organic vapours) rubber aprons, goggles and boots. |

5.1.5 Mercury

Mercury can be found in equipment such as thermometers, blood pressure apparatus and sphygmomanometers. Mercury is also used in dental amalgams. Exposure to mercury in the hospital is usually the result of an accidental spill arising from breakage of mercury-containing equipment and apparatus. Although inhalation is the major route of entry for mercury, the element can also be absorbed through the skin.

Exposure to short-term high levels of mercury can produce severe respiratory irritation, digestive disturbances and marked renal damage. Long-term exposure to low levels of mercury results in the classic mad hatter syndrome, named for the makers of felt hats who used mercury in processing.

This syndrome is characterised by emotional instability and irritability, tremors, inflammation of the gums, gingivitis, excessive salivation, anorexia, and weight loss. Mercury has also been reported as a cause of sensitisation dermatitis. The permissible exposure limit for mercury vapour is 0.025 mg/m3 (long term). Employees who are exposed to or are handling mercury or its compounds are required to undergo medical examinations. The test required is urine mercury and this must be conducted by a Designated Workplace Doctor and the results submitted to the MOM.

*Monitoring*
For personnel who are performing work where there could be exposure to mercury, workplace toxic substances monitoring will need to be conducted regularly to determine workers' exposure and assess the effectiveness of controls in reducing mercury exposure in the work area. The monitoring report for these substances must be submitted to the MOM.

Personnel carrying out work where there could be exposure to mercury are required to undergo pre-placement and regular medical examinations to ensure fitness to work with mercury. These results complement the toxic substance monitoring in assessing workers' exposures and the effectiveness of controls. The results have to be submitted to the MOM.

*Disposal*
The mercury waste generated will need to be properly disposed according to NEA's toxic industrial waste requirements.

Table 7: Examples of control measures to reduce exposure (mercury).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Elimination/Substitution | • Replace mercury-containing equipment with non-mercury alternatives. |

| | |
|---|---|
| Engineering Controls | • Provide exhaust systems to prevent the accumulation or recirculation of mercury vapours in equipment maintenance rooms/biomedical workshops. |
| Administrative Controls | • Provide mercury spill clean-up kits and training for emergency response staff.<br>• Establish emergency procedures for handling mercury contamination including procedures for cleanup and for respirator selection. |

5.1.6 Natural Rubber Latex

A number of proteins that make up Natural Rubber Latex (NRL) can cause the development of occupational asthma and dermatitis in people exposed to them. In powdered NRL gloves, the proteins are easily carried on the cornstarch powder and can become airborne and inhaled.

Chemicals known as accelerators such as thiurams, dithiocarbamates and mercaptobenzothiazoles (MBT) added to the latex during the processing phase are also likely to elicit reactions.

Healthcare workers are also exposed to NRL by direct contact or chemicals in rubbers and plastics.

Exposure Situations

- Healthcare workers in direct patient care where the use of gloves is required and NRL gloves are used – clinics, operating theatres, clinical and research laboratories, wards, Intensive Care Units (ICUs) and autopsy rooms.
- Use of rubber containing equipment such as IV bungs, catheters, sphygmomanometers, drains, dental dams, anaesthesia masks and stethoscopes.
- Rubber containing consumer products e.g., rubber bands, utility gloves, stress balls and erasers.
  *Stretchy rubber products pose a higher risk than dry rubber products.

Workers at Risk

- Healthcare workers using NRL gloves particularly the powdered type– doctors, dentists, nurses, laboratory staff, research staff and pathologists.
- Kitchen staff, waste disposal staff, security staff.
- Workers with past history of multiple surgical procedures.
- Workers with history of certain food allergies such as banana, avocado, kiwi and chestnut.
- Workers with atopic allergic diseases.

Table 8: Examples of control measures to reduce exposure (NRL).

| **Control Approach** | **Examples of Control Measures** |
|---|---|

| | |
|---|---|
| Elimination / Substitution | • Substitute NRL gloves with alternatives such as vinyl or other non-latex gloves.<br>• Use low protein, powder-free gloves.<br>• Provide appropriate non-latex gloves in non-clinical tasks. |
| Administrative Controls | • Educate and raise awareness. |
| Personal Protective Equipment | • Provide appropriate latex-free PPE. |

Further information can be obtained from:

- Health and Safety Executive (HSE), UK: Latex allergy – Occupational aspects of management – A national guideline
- CDC, NIOSH: NIOSH Alert: Preventing Allergic Reactions to Natural Rubber Latex in the Workplace

### 5.1.7 Hazardous Drug Handling

Hazardous drugs are drugs or chemicals that demonstrate one or more of the following characteristics in either humans or animals: carcinogenicity, teratogenicity or other developmental toxicity, reproductive toxicity, organ toxicity at low doses, genotoxicity or where the structure and toxicity profiles of new drugs mimic existing drugs determined hazardous by the above criteria.

Commonly, this would include cytotoxic, anti-neoplastic, anti-viral as well as new bio-engineered drugs. Although the drugs kill or damage cancer cells, they can also damage normal cells. Coupled with the increasing use and complexity of chemotherapy as well as the unknown effects of new drugs, this has led to concerns over the risks to healthcare workers involved in the preparation, handling, administration and disposal of these drugs. Such drugs administered to patients may also be excreted unmetabolised in their urine, resulting in exposure to nurses, attendants, housekeeping and waste disposal staff.

#### Effects

Some studies have shown that exposure to these drugs can cause acute health effects such as skin and eye irritation, and chronic health effects including adverse reproductive outcomes such as infertility, miscarriage, birth defects and possibly leukaemia and other cancers.

#### Exposure Situations

Hazardous drugs are commonly administered by injection as single doses or as a continuous infusion. Some drugs can also be given orally as tablets, capsules or as liquids.

The potential for exposure exists during various tasks such as drug reconstitution and mixing, connecting and disconnecting intravenous tubing, and disposing of waste equipment or patient waste.

Drugs can also be found in the air, on work surfaces, clothes, medical equipment and in patients' urine and faeces.

The common routes of exposure are through skin and mucous membrane contact (in spills and splashes) and inhalation (e.g. overpressurising vials), but ingestion (eating or drinking in contaminated areas) or injection (needlestick injuries) can also occur.

Some of the areas where exposure could occur include:

- Hospitals;
- Hospices;
- Oncology units;
- Pharmacies;
- Wards;
- Reception and delivery areas;
- Infusion centres; and
- Laundry areas.

Activities where exposure could occur include:

- Drug reconstitution and mixing;
- Connecting and disconnecting intravenous tubing;
- Housekeeping;
- Maintenance of equipment;
- Disposal of waste equipment;
- Disposal of patient waste; and
- Laundering of contaminated bed linen and patient clothing.

Workers at Risk

- Pharmacists and pharmacy technicians;
- Nurses and nursing assistants;
- Operating room staff;
- Doctors;
- Hospital attendants and transport staff;
- Facility staff receiving and transporting stock;
- Biological waste handlers/cleaners/environmental services staff; and
- Laundry staff handling contaminated linen, bed clothes, bedding, etc.

Health and Safety Management System for Use of Hazardous Drugs

Due to the potent nature of these drugs and their potential for harm, a management system should be in place to protect the health and safety of healthcare and other workers coming into contact with these drugs. The system should include management of the movement of the drugs from entry into the facility through preparation and administration, waste disposal, equipment maintenance and housekeeping, spill control to medical surveillance. There should be periodic review of the health and safety management system.

Risk Assessment

Management should ensure that proper RAs are conducted for all activities where there is handling of or exposure to hazardous drugs. An RA is a means of determining the risk associated with exposure to a particular hazard or work. The steps in conducting an RA include:

- Hazard identification; all institutions should develop and maintain their own list of hazardous drugs in use;
- Determine workers at risk and how harm could arise;
- Likelihood of harm arising, assessment of adequacy of existing precautions;
- Documentation of findings and control measures selected as well as any other steps necessary to reduce exposure risk; and
- Reviewing the RA if the nature of work changes or if there is a change in the process.

The coverage of the RA should include:

- Routine work;
- Non-routine work;
- Emergency situations;
- Activities of personnel with access to the facility such as visitors, volunteers, subcontractors and workers;
- Vulnerable persons such as new and expectant mothers and those with impaired immune systems, young and trainee workers; and
- All facilities in your workplace.

Risks should be controlled at source as much as possible. RAs should be documented and kept current.

Exposure Control

Measures to control exposure should be applied in the following order.

- Use totally enclosed systems as the first choice for controlling exposure to carcinogens, unless this is not reasonably practicable;
- Control exposure at source, including use of adequate ventilation systems and appropriate organisational measures; and
- Issue PPE where adequate control of exposure cannot be achieved by other measures alone.

The broad measures described above will include more specific controls such as:

- Organising work to reduce the quantities of drugs used, reducing the number of employees potentially exposed and keeping their duration of exposure to a minimum;
- Arranging for the safe handling, storage and transport of cytotoxic drugs;
- Practising good hygiene measures such as prohibiting eating, drinking and smoking in areas where drugs are handled, and providing washing facilities; and

- Training all staff who may be involved in handling cytotoxic drugs or cleaning areas likely to be contaminated on the risks and the precautions to be taken.

Safe Work Procedures

There should be written SWPs on any work where there is exposure to hazardous drugs. Areas that require these SWPs would include patient care areas, operating theatres, pharmacies, laundry, mortuary, waste disposal and biomedical maintenance. These SWPs should include the use of appropriate safety equipment, PPE and techniques on safe handling of such drugs as well as the safety and health precautions to be taken in the course of work.

In addition, a safe drug handling programme should be established and incorporate the following.

- Policies and procedures defining:
  - Presence of hazardous drugs;
  - Labelling of drugs;
  - Storage of drugs;
  - Personnel issues (vulnerable workers such as expectant workers, young workers, trainees etc.);
  - Spill control; and
  - Detailed procedures for preparing, administering, and disposing of hazardous drugs;
- Procedures and training for handling hazardous drugs safely, cleaning up spills, and using all equipment and PPE; and
- Safe work practices relating to both drug manipulation techniques and to general hygiene practices such as not permitting eating or drinking in areas where drugs are handled e.g. the pharmacy or clinic.

Personal Protective Equipment

- PPE includes respirators, safety glasses, face shields, overalls, aprons, gloves and boots;
- Selection of PPE should be based on routes of potential exposure to hazardous drugs and other concomitant hazards and the nature of work;
- Employers need to ensure that employees are trained in the use of PPE and that the equipment is adequately maintained;
- To ensure that employees are effectively protected, PPE should be properly selected, correctly used, comfortably fitted and regularly maintained;
- Effective protection can only be achieved if the PPE chosen is:
  - Suitable for the task;
  - Suited to the wearer and environment;
  - Compatible with other PPE in use;
  - In good condition; and
  - worn correctly.
- Gloves:

  - Where there is contact with cytotoxic drugs, and methods of control other than protective gloves are not reasonably practicable, protective gloves must be provided for employees; and
  - Gloves should be changed regularly or when integrity is breached, torn or damaged.
- Eye and face protection:
  - Eye and face protection is relevant particularly where cytotoxic drugs are being handled outside an enclosed system and there is a risk of splashing. Several options are available including a face shield or visor, goggles and safety spectacles.
- Respiratory protection:
  - Preparation of cytotoxic drugs should be carried out in a suitable safety cabinet or pharmaceutical isolator. However, if it is not reasonably practicable to control exposure using total enclosure/local exhaust ventilation, respiratory protective equipment (RPE) should be considered if exposure to:
  - powders or aerosols is possible. (Note: Surgical masks will not protect against the inhalation of fine dust or aerosols);
  - Manipulation of oral or topical medicines containing cytotoxic drugs should be avoided if possible. If this is unavoidable, tasks such as dividing or crushing tablets should be restricted to a controlled environment, ideally within a pharmacy department. Carrying out these procedures in wards or clinics should be actively discouraged;
  - A suitable PPE programme should be implemented taking the above elements into consideration; and
  - If respirators are used, a respiratory protection programme should also be in place to manage the use such equipment.

Disposal

A hazardous waste management system should be established that includes proper labelling according to national or international codes, proper storage, treatment, transport and disposal of such wastes.

Emergency Planning

Plans should be in place to deal with incidents such as hazardous spills and splashes, particularly if the spill occurs outside the biological safety cabinets. The plan should describe what needs to be done that includes emergency procedures, first aid procedures, use of safety equipment and PPE required, decontamination and cleaning, and waste disposal.

Proper spill kits and clean up kits should be placed within easy reach where possible exposures might occur and staff should be trained in their use. Appropriate PPE should also be used when cleaning up spills. Any drugs that come into direct contact with the skin should be washed off with soap and water immediately and medical advice should be sought. If drugs come into direct contact with the eye, they should be washed out quickly with running water or an eye wash bottle containing water or normal saline. Medical advice should then be sought.

Education and Training

All affected workers should be informed about the hazardous drugs that they could be exposed to, and the risks involved. They should also be informed of the control measures and precautions that they should take as well as the necessary PPE, emergency response and first aid procedures. Staff should also be conversant with exposure monitoring requirements and relevant SWPs.

*Monitoring Exposure at the Workplace*

Monitoring exposure can include any periodic test or measurement which helps to confirm the ongoing effectiveness of controls. Where there is exposure to cancer-causing drugs, it is a good practice to monitor the workplace for exposure.

Performing serial measurements and observing trends in the data can be useful to help demonstrate that control measures are still adequate or the need to review them. These monitoring techniques can also help confirm restoration of adequate control if there is a failure of the measures put in place.

*Health Surveillance*

A medical surveillance programme should be in place to monitor the health of workers exposed to hazardous drugs. The elements of a medical surveillance programme would include:

- Questionnaires on reproductive and general health at the time of employment and periodically during employment;
- Laboratory tests including complete blood counts, urinalysis and any other relevant tests such as liver function and renal function done at employment and periodically during employment;
- Physical examination of healthcare staff at time of employment and periodically where indicated by either the questionnaire or laboratory tests;
- Workers who have significant exposure to spills and splashes should also be on the monitoring programme;
- Workers with significant change in health status detected should also be on a follow-up programme;
- Results of questionnaires and tests should be monitored for trends that may be a sign of health effects due to exposure. If there are significant health changes, the employer should:
  - Evaluate current preventive measures; engineering control measures (biological safety cabinets, containment, ventilation, closed system transfer devices and IV infusion systems);
  - Compare performance with recommended standards;
  - Perform environmental sampling where possible;
- Work practices;
- PPE requirements and employees' compliance and use;

- Availability of appropriate PPE such as double gloves, non-permeable gowns, respiratory protection;
- Develop or refine a plan to prevent further worker exposure;
- Offer alternative duty or reassignment to affected worker; and
- Continue ongoing medical surveillance of all workers at risk.

*Record Keeping*

Exposure records of employees who work with hazardous drugs must be properly kept and maintained. Information in the records should include type of work, location of work done and any specific incidents or exposures that occurred. These records should be kept for at least five years.

Hazards and Controls on Selected Work Activities and Areas

*Receiving and Storage of Areas*

The main hazard is spills from damaged containers or when handling intact containers.

Table 9: Examples of control measures to reduce exposure (Drug receiving and storage).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Provide sufficient general exhaust ventilation.<br>• Consider dedicated emergency exhaust fan powerful enough to quickly purge airborne contaminants in the event of a spill. |
| Safe Work Practices | • Store and transport in closed containers.<br>• Ensure proper labelling.<br>• Observe for potential cracks/damaged containers/leakage.<br>• Cover all cuts/lacerations with plasters. |
| Administrative Controls | • Educate and train staff on hazards, effects, safe work practices and use of PPE. |
| Personal Protective Equipment | • Use appropriate PPE such as:<br>- Chemotherapy gloves when receiving, handling, unpacking and transporting vials to work areas;<br>- Protective clothing; and<br>- Eye and face protection. |

*Drug Preparation and Administration*

The hazard analysis should include a review of the whole process. Access to the preparation areas should be limited. The job tasks should be coordinated for effective control of exposures to workers. In addition, a spill control programme should be in place in the event of spills and splashes.

Table 10: Examples of control measures to reduce exposure (Drug preparation).

| **Control Approach** | **Examples of Control Measures** |
|---|---|

| | |
|---|---|
| Engineering Controls | • Prepare drugs in ventilated cabinets. Ideally use a totally enclosed cabinet.<br>• Consider using closed system transfer devices, glovebags and needleless systems for transfer of drugs from primary packaging to dosing systems (to be done inside a ventilated cabinet). |
| Safe Work Procedures | • Wash hands before putting on gloves.<br>• Seal the finished product in a container before removing from ventilated cabinet.<br>• Seal and wipe all waste containers inside a ventilated cabinet before removal for disposal.<br>• Remove all outer gloves and sleeve covers and bag for disposal while still inside a ventilated cabinet.<br>• Follow the proper sequence of removing PPE.<br>• Dispose all PPE immediately after use.<br>• Compounding of drugs and counting of tablets should be done in a biological safety cabinet if it is likely to produce dust such as non-coated tablets. |
| Administrative Controls | • Prepare hazardous drugs in a centralised area where possible.<br>• Train all staff in safe work practices and use of proper equipment.<br>• Ensure SDS of drugs are available. |
| Personal Protective Equipment | • Use proper PPE.<br>• Use chemotherapy gloves or double gloving when opening drug packaging, handling vials/finished products, labelling or disposing of hazardous waste.<br>• Ensure latex free gloves are available for those with latex allergy.<br>• Change gloves regularly according to recommendations on SDS and/or when integrity is breached (torn or damaged).<br>• Use proper disposable gowns made of polyethylene-coated polypropylene with closed fronts, long sleeves, elastic or knit cuffs.<br>• Consider using disposable sleeve covers to protect wrist area.<br>• Use appropriate respirators if ventilated cabinets are not available.<br>• Use eye and face protection if aerosol is anticipated.<br>• Dispose PPE immediately after use according to national regulations. |

Table 11: Examples of control measures to reduce exposure (Drug administration).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Administer drugs by using needleless and closed systems.<br>• Use Luer-lock fittings. |
| Safe Work Procedures | • Carry an emergency spill kit when transporting hazardous drugs from preparation to administration areas. |

| | |
|---|---|
| | • Put the emergency spill kit at hand or nearby while administering the drugs.<br>• Place plastic backed absorbent pads under IV line to catch leakages.<br>• Place sterile gauze under push sites.<br>• Tape IV tubing connection sites.<br>• Observe standard precautions.<br>• Wipe all syringes, IV bags, lines and pumps clean of hazardous drugs.<br>• Do not remove IV tubing from bag containing hazardous drugs beside patient's bed.<br>• Flush tubing at end of infusion before removing IV bag and tubing.<br>• Dispose IV bag and line intact in accordance with pharmacy instructions or legislative regulations.<br>• Place disposable items in a purple chemotherapy waste container and close lid.<br>• Remove protective clothing in the proper sequence;<br>• Double-bag all chemotherapy waste bags.<br>• Dispose PPE immediately after use according to national regulations. |
| Administrative Controls | • Train staff on the proper SWPs and proper use of PPE.<br>• Restrict the number of staff who are allowed to administer hazardous drugs.<br>• Check Luer-lock fittings for leaks.<br>• Prime IV line inside ventilated cabinet if using hazardous drugs if not primed with non-drug solution. |
| Personal Protective Equipment | • Use chemotherapy/latex gloves when handling and administering hazardous drugs.<br>• Double glove if using latex gloves.<br>• Change gloves regularly and when integrity is breached (torn or damaged).<br>• Ensure latex free gloves are available for those with latex allergy.<br>• Use proper disposable gowns made of polyethylene-coated polypropylene with closed fronts, long sleeves, elastic or knit cuffs.<br>• Wear chemical splash goggles or equivalent safety glasses.<br>• Use appropriate respirators when handling aerosolised drugs or if aerosols is expected.<br>• Dispose PPE immediately after use according to national regulations. |

*Ventilated Cabinets/Biological Safety Cabinets*

- Preparation of hazardous drugs should be done in a dedicated cabinet.

- Selection should be based on needs such as aseptic drug preparation and worker's safety and health considerations.
- Selection criteria should include the design *o*f airflow and exhaust so there is sufficient flowrate, laminar flow, use of non-recycled air, etc.
- There should be real time monitoring of cabinet performance.

*Maintenance of Ventilated/Biological Safety Cabinets*

*(1) Routine maintenance*

- A work plan should be in place for regular testing of HEPA filters, leak tests and other performance characteristics.
- Safety protocols and procedures should be developed for safe work practices when conducting routine maintenance, including lockout/tagout procedures, signages, proper disposal and PPE use.
- Maintenance staff should be trained in hazards, proper work procedures and work practices.
- Appropriate PPE should be provided including gowns, eye and face protection, gloves and shoes.
- Ensure proper disposal of used filtration media according to national regulations.

*(2) Non-routine maintenance (e.g., servicing and upgrades)*

- The same precautions for routine maintenance should also apply.

*Spill Control*

There should be policies and procedures to manage spills which include:

- A respiratory protection programme; and
- Standard operating procedure in the event that personnel are also contaminated.

Table 12: Examples of control measures to reduce exposure (Spill control).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Safe Work Procedures | • Correct selection and use of materials in spill kit.<br>• Proper handling of spills.<br>• Use of appropriate PPE.<br>• Locate spill kits in immediate vicinity of potential spill areas.<br>• Dispose contaminated materials/equipment properly according to NEA regulations on hazardous waste |
| Administrative Controls | • Education and training on safe work practices.<br>• Educate and train staff in safe work practices.<br>• Proper warning signs.<br>• Allow access only to authorised and trained personnel.<br>• Spill handling drills. |

| | |
|---|---|
| | • Establish standard operational procedures (SOPs) in the event of personnel contamination. |
| Personal Protective Equipment | • Use appropriate PPE such as gloves, respirators and face protection, gowns and footwear.<br>• Include respiratory protection programme.<br>• Dispose PPE immediately after use according to national regulations. |

*Medical Waste Disposal*

Identify all possible types of waste generated by preparation and administration of hazardous medications such as partially filled vials, undispensed products, unused IV medications, needles and syringes, gloves, gowns, underpads, bed linen and contaminated materials from spill clean-ups.

Do not place needles and sharps contaminated with cytotoxic wastes into infectious disease containers. Put needles, empty vials and sharps (preferably as one unit) in puncture proof plastic waste containers. When full, the container should be placed in purple cytotoxics bag. Put syringes, gloves, gowns, and tubing into purple cytotoxic waste bags.

Radioactive waste should be placed in red bags for disposal by licensed NEA contractors. Incinerate at regulated medical waste facility – use licensed NEA disposal contractors for biohazardous waste (refer to NEA for further information).

*Routine Cleaning, Decontaminating and Housekeeping*

Table 13: Examples of control measures to reduce exposure (Routine cleaning/ Decontamination).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Ensure sufficient ventilation to prevent build-up of hazardous airborne drug concentrations. |
| Safe Work Procedures | • Clean work surfaces with an appropriate deactivating agent before and at the end of each activity and at the end of each work shift. |
| Administrative Controls | • Implement protocols for proper storage of hazardous drugs according to NEA and other international guidelines.<br>• Do not store and use hazardous drugs in unventilated areas such as unventilated storage closets or rooms.<br>• Plan a schedule of regular cleaning activities for work surfaces and equipment that might become contaminated e.g. trolleys and carts etc should be in place. |
| Personal Protective Equipment | • Put on appropriate eye protection such as safety glasses with side shields or face shields when there is risk of liquid splash. |

| | |
|---|---|
| | • Use appropriate gloves according to SDS and glove selection guidelines.<br>• Use gloves that are chemically resistant to decontaminating or cleaning agent.<br>• Use double gloves.<br>• Ensure availability of latex-free gloves for those with latex allergy.<br>• Use disposable fluid resistant gowns if necessary.<br>• Dispose PPE immediately after use according to national regulations. |

Table 14: Examples of control measures to reduce exposure (Housekeeping).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Safe Work Procedures | • Use appropriate PPE such as gowns, gloves, eye and face protection, footwear etc.<br>• Place linen contaminated with hazardous drugs or excreta from patients who have received hazardous drugs in the last 48 hours in specially marked and labelled laundry bags which are then placed in another impervious bag (double bagging).<br>• Pre-washed contents of laundry bag before adding to the other laundry for a second wash.<br>• Follow standard precautions when handling excreta contaminated with blood.<br>• Wash reusable items such as glassware or other contaminated items twice with detergent by a trained employee wearing double latex gloves and a gown.<br>• Wash hands with soap and water after removal of gloves.<br>• Procedure for removal of gloves:<br>- Remove outer gloves and gown by turning them inside out and placing them in a purple bag; and<br>- Repeat the procedure with the inner glove. |
| Administrative Controls | • Educate and train all nursing, housekeeping and biological waste disposal staff on effects of exposure to hazardous drugs and the precautions to take |
| Personal Protective Equipment | • Use face shields where splashing may occur.<br>• Use fluid resistant disposable gowns which should be changed whenever contaminated.<br>• Use appropriate gloves; double glove if handling linens, faeces or urine from patients who had received hazardous drugs within the last 48 hours up to the last seven days.<br>• Linen personnel should wear latex gloves and gowns when handling prewashed material.<br>• Suitable latex free gloves should be made available for those with latex allergies. |

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|---|---|
| | • Dispose PPE immediately after use according to national regulations. |

Further information can be obtained from:

- US OSHA: Technical Manual. Section VI Chapter 2: Controlling Occupational Exposure to Hazardous Drugs
- CDC, NIOSH: Preventing Occupational Exposures to Antineoplastic and Other Hazardous Drugs in Healthcare Settings
- CDC, NIOSH: Medical Surveillance for Healthcare Workers Exposed to Hazardous Drugs
- HSE, UK: Safe handling of cytotoxic drugs in the workplace
- NEA: Hazardous Substances
- NEA: Toxic Waste Control

## 5.2 Biological and Infectious Hazards

In treating and caring for patients, healthcare workers and supporting staff are exposed to various infections such as Hepatitis B, Hepatitis C, HIV, Mycobacterium tuberculosis, varicella zoster (VZV), SARS CoV, SARS Cov 2, measles, mumps, rubella, gastrointestinal infections and scabies. In addition, exposure to animals and vegetable matter can cause allergies, dermatitis and asthma.

### 5.2.1 Infectious Diseases

Healthcare workers are exposed to infectious agents by inhalation, injection, ingestion or dermal contact. As infectious agents have the potential to multiply, breaking the chain of transmission is important in the control of infection.

Factors to determine if the healthcare worker has been infected are:

- How the infection is spread;
- Dose of the organisms;
- Duration of exposure;
- Virulence of the infectious organisms;
- Availability of vaccines;
- Immunity of healthcare worker;
- Availability of post-exposure prophylaxis where applicable; and
- How well the organism survives in the environment.

Infectious Disease Management Programme

Facilities should implement a health and safety management programme for infectious diseases to protect the health of the workers. This means taking an active role in carrying out risk assessments, setting health and safety standards and developing policies, together with

monitoring of standards and enforcement of compliance. Specific functions such as carrying out risk assessments may be assigned to the management line.

*Management Policy and Strategy*

The policy is a written statement of a facility's intent to provide a safe and healthy environment and should enlist the support of employees in achieving its aims. The policy should detail the health and safety responsibilities within the facility. There should be systems and procedures in place for ensuring health and safety of its employees. All areas where there is potential exposure to biological hazards such as wards, clinics, operating theatres, sterilising departments, cleaning, housekeeping, laundry and portering and so on should be included.

*Register of Work Activities*

A register of all processes related to infection control should be documented including routine, non-routine work, disposal of infectious matter, housekeeping, laundry and maintenance of contaminated equipment. This register should also include information on the staff who may be exposed and the areas in where they work.

*Risk Assessment and Risk Control*

Management should ensure that proper RAs are conducted for all activities where there is handling or exposure to infectious agents. RA is a means of determining the risk associated with exposure to the hazards arising from the work activity. See Chapter 4 for the steps in performing RA and related information.

*Safe Work Procedures*

There should be written procedures on any work where there is exposure to infectious matter and should include emergency areas, patient care areas, operating theatres, laboratories, housekeeping and laundry, mortuary waste disposal and biomedical maintenance.

The SWPs should include the correct use of appropriate PPE and the safety and health precautions to be taken in the course of work. Existing programmes such as infection control programme, tuberculosis (TB) infection control, standard precautions for prevention of bloodborne infections, contact, airborne and droplet precautions can be incorporated into the infectious disease management programme.

The use of standard precautions applies to all patients in any health care facilities. It is based on the premise that blood, body fluids, secretions, excretions except sweat, non-intact skin and mucous membranes may contain transmissible infectious agents. The components are hand hygiene, use of PPE such as gloves, fluid resistant gowns, mask, eye or face shield and proper handling of potentially contaminated equipment. The extent of PPE used depends on the risk of healthcare workers – patient interaction. Healthcare workers should ensure that PPE are not brought out of clinical or laboratory areas.

*Environmental Infection Control*

Certain infections can be transferred by direct contact with contaminated surfaces. There should be a programme for cleaning and decontaminating clinical contact areas in order to reduce transfer of infections to healthcare workers and other patients. Maintaining a clean environment by good housekeeping would also reduce disease transmission.

*Disposal*

Operations where biological/infectious wastes are generated should be governed by a waste management system that include proper labelling according to national or international codes, proper storage, treatment, transport and disposal of such wastes.

*Personal Protective Equipment*

PPE includes respirators, safety glasses, face shields, overalls, aprons, gloves and boots. Selection of PPE should be based on transmission routes of infection, risk group of the organisms, other concomitant hazards and the nature of work. To ensure that employees are effectively protected, PPE should be properly selected, correctly used, comfortably fitted and regularly maintained. A suitable PPE programme should be implemented taking into account the above elements.

*Emergency Planning*

Emergency planning is required for incidents, accidents or emergencies that might occur such as sharps injuries, aerosolisation of highly infectious organisms, spills of organisms outside of biological safety cabinets. The plan should describe what needs to be done.

For example, emergency procedures, first aid procedures, use of safety equipment and appropriate PPE, decontamination and cleaning, and proper waste disposal. Emerging infectious diseases is another area that should be catered for.

*Post-Exposure Programme*

A post-exposure programme should be implemented to cope with employees who are infected with or occupationally exposed to infectious diseases. Treatment given would depend on the nature and type of infection the worker has been exposed to. The programme should also address if a healthcare worker should be restricted from work and determine when he/she would be fit to return to work.

*Health Surveillance*

Surveillance is defined as an ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality, and to improve health.

A system should be put in place to detect early signs of work-related ill health in employees exposed to certain health risks and to act on the results.

*Vaccinations (Immunoprophylaxis)*

Employees at increased risk of exposure to vaccine-preventable infections such as Hepatitis B, influenza, varicella zoster, measles, rubella and Covid-19 might benefit from the implementation of a vaccination programme. The programme should incorporate information on the epidemiology of such infections and include inputs from an infectious disease consultant in accordance with the institution's policy or any other regulatory guidelines.

*Case Finding*

A facility should have a system for active case finding of healthcare workers with clusters of fever symptoms, gastrointestinal or other symptoms, or single cases of sharps injuries, occupational asthma, dermatitis and other occupational diseases. A systematic epidemiologic investigation should be done to determine commonalities in persons, place, and time; and guide implementation of interventions and evaluation of the effectiveness of those interventions.

*Records*

A facility should keep exposure records of its employees who work with more hazardous organisms in the laboratories or in clinical areas. Information in the records should include type of work, location of work done and specific incidents or exposures that occurred. Where required by current legislation, occupational diseases should be reported to MOM. All records should be properly kept and maintained for at least five years.

*Monitoring and Review*

Information on occurrence of infectious diseases should be monitored and analysed with regard to frequency, health effects, absenteeism and performance of the safety and health management system. The safety and health management team should review the overall policy, planning and implementation of the infectious disease management programme regularly to ensure it effectiveness and relevance.

*Education and Training*

All employees should be given suitable and sufficient information about the biological agents they could be exposed to and the risks due to the exposure. They should also be informed of the results of the RA, the measures to take, usage of PPE, emergency and first aid procedures, infection control policies, vaccinations, post-exposure prophylaxis and reporting procedures for occupational accidents and diseases. A health and safety training programme should be implemented to ensure that SWPs are known and understood by all staff.

5.2.2 Bloodborne Pathogens

Healthcare workers are potentially exposed to bloodborne pathogens such as Hepatitis B, Hepatitis C and HIV. They are at risk to these diseases from getting infected by needlestick injures or cuts from other sharp objects contaminated with an infected patient's blood or through contact of the eyes, nose, mouth or non-intact skin with an infected patient's blood or bodily fluids. Hepatitis B, Hepatitis C and HIV/AIDS are the most common infections that can be transmitted to healthcare workers by blood and bodily fluids. The main routes of exposure are by percutaneous inoculation or permucosal means i.e. contact of an open wound, non-intact skin or mucous membranes (due to spills and splashes).

Exposure Situations

- Procedures resulting in a percutaneous injury or contact of mucosal membrane or non-intact skin with infected blood, tissues or bodily fluids such as needlestick or sharps injuries, spills or splashes and human bites;
- Venepuncture e.g. in wards, clinics and operating theatres;
- Laboratory work e.g. in clinical laboratories, research laboratories, animal facilities;
- Surgery e.g. in operating theatres;
- Resuscitation e.g. in emergency departments, wards, operating theatres;
- Transport of injured patients who have open bleeding wounds;
- Post-mortem procedures – autopsy rooms;
- Disposal of biohazardous waste e.g. in wards, clinics, operating theatres, laboratories, waste holding and treatment areas; and
- Repair of medical and dental equipment.

Workers at Risk

- Doctors;
- Nurses;
- Phlebotomists;
- Laboratory workers;
- Emergency room staff;
- Waste handling and disposal workers;
- Ambulance and related staff;
- Biomedical technicians and engineers; and
- Mortuary staff.

Table 15: Examples of control measures to reduce exposure (Bloodborne pathogens).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Elimination /Substitution | • Eliminate use of needles or sharps for IV drug delivery.<br>• Consider use of alternative IV delivery systems.<br>• Consider substitution of non-needle systems for certain types of blood prick tests.<br>• Explore other routes of medication delivery e.g. oral.<br>• Review specimen collection procedures. |
| Engineering Controls | • Engineer sharps or needles with built-in sharps injury prevention features.<br>• Adopt a needleless intravenous (IV) delivery systems.<br>• Use blunt tipped suture needles where appropriate.<br>• Use blunt-ended scissors. |

| | |
|---|---|
| | • Place proper sharps disposal containers in convenient locations. |
| Safe Work Practices | • General safe work practices:<br>- Prohibit eating, drinking, smoking and the application of cosmetics in areas where there is a risk of contamination;<br>- Prevent puncture wounds, cuts and abrasions, especially in the presence of blood and body fluids;<br>- Cover all breaks in exposed skin by using waterproof dressings and suitable gloves; and<br>- Procedures for administration of medications to confused or combative patients.<br>• Use standard precautions:<br>- Hand hygiene before and after procedures; and<br>- Safe handling of needles and sharps - no recapping, bending, breaking needles.<br>• Safe injection practices:<br>- Practise basic principles of aseptic technique for the preparation and administration of parenteral medications;<br>- Use sterile, single-use, disposable needle and syringe for each injection given;<br>- Prevent contamination of injection equipment and medication;<br>- Use single-dose vials (preferred over multiple- dose vials);<br>- Dispose glass ampoules properly as soon as withdrawal of contents is completed; and<br>- Proper patient handling techniques for phlebotomy on uncooperative patients.<br>• Control contamination of surfaces:<br>- Contain the infectious agents;<br>- Use appropriate decontamination procedures by heat or chemical means; and<br>- Proper management of spills and other forms of contamination.<br>• Safe handling and disposal of waste:<br>- Use appropriate sharps containers i.e. puncture-resistant plastic containers.<br>• Work in operating theatres:<br>- Use instruments, rather than fingers, to grasp needles, retract tissue, and load/unload needles and scalpels;<br>- Give verbal announcements when passing sharps;<br>- Avoid hand-to-hand passage of sharp instruments by using a basin or neutral zone;<br>- Use alternative cutting methods such as blunt electrocautery and laser devices when appropriate;<br>- Substitute endoscopic surgery for open surgery where possible; and |

| | |
|---|---|
| | - Use round-tipped scalpel blades instead of sharp-tipped blades.<br>• Maintain and ensure proper cleaning and decontamination of equipment.<br>• Adopt infection control practices for special lumbar procedures. |
| Administrative Controls | • Develop a management policy on healthcare workers infectious for HBV, HCV and HIV and exposure prone procedures.<br>• Screen HBV, HCV and HIV for healthcare workers especially those who perform exposure prone procedures:<br>• Provide counselling for above workers.<br>• Education and awareness:<br>- Staff should be aware of the hazards of bloodborne infections and trained in safe work practices. |
| Personal Protective Equipment | • Use appropriate PPE such as:<br>- Impervious gowns;<br>- Gloves;<br>- Eye protection such as face shields / goggles / safety spectacles / visors where splashes are possible; and<br>- Rubber boots or plastic overshoes where the flooring / ground is likely to be contaminated. |

Further information can be obtained from:

- Ministry of Health (MOH) Singapore: Guidelines for Preventing Transmission of Bloodborne Infections in a Healthcare Setting

5.2.3 Infectious Agents other than Bloodborne Pathogens

Pathogens of various classes such as bacteria, viruses, fungi, parasites, prions can cause infections. The routes of infection vary with the organism and type of infection. Some organisms can also be transmitted by multiple routes and not all organisms are transmissible from person to person.

Droplet Infections

Respiratory droplets (usually more than 5µm in diameter) carrying infectious pathogens transmit infections when they travel directly from the respiratory tract of the infectious individual to the mucosal surfaces of the susceptible recipient, usually over short distances. This usually happens when infected patients cough, sneeze or talk and healthcare workers inhale the particles. Examples of infections spread in this way are SARS-CoV, SARS CoV 2, Mycobacterium tuberculosis (TB), influenza, adenovirus, rhinovirus, Group A Streptococcus, Mycoplasma pneumoniae, Bordetella pertussis and Neisseria meningitidis.

Exposure Situations

- High risk situations where there is aerosolisation of patient's respiratory secretions such as endotracheal intubation, bronchoscopy, sputum induction, performance of laryngeal swabs, cough induction by chest physiotherapy, cardiopulmonary resuscitation, surgical procedures, autopsy etc.
- Caring for infective patients i.e. individuals with infections such as SARS, TB, influenza etc.
- Generation of aerosols of infected laboratory samples.
- Dental procedures.

Workers at Risk

- Healthcare workers in direct patient care particularly departments of respiratory medicine, infectious diseases, emergency care, and areas involving care of immunocompromised patients.
- Clinical and research laboratory workers.
- Mortuary workers and autopsy room staff.
- Dental healthcare workers including dentists, assistants and technicians.

Table 16: Examples of control measures to reduce exposure (Droplets).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Negative pressure rooms are desirable.<br>• Consider use of microbiological safety cabinets for laboratory work such as immunomagnetic separation and innoculation of biochemical test kits that may generate aerosols. |
| Safe Work Practices | • Droplet precautions:<br>- Provide single occupancy room for patient;<br>- Cohorting of patients if single room is unavailable –to discuss with infectious disease consultant;<br>- Spatial separation of more than one metre between beds in multi-bed wards;<br>- Keep curtain drawn between beds in multi-bed wards;<br>- Use of fluid resistant mask for close contact with infectious patient;<br>- Mask to be donned on entry to room;<br>- Change protective attire and perform hand hygiene between contact with patients in the same room; and<br>- Adhere to the proper sequence of removing PPE.<br>• Patients to wear a fluid resistant mask (if tolerated) when being transported outside the room and to follow respiratory hygiene / cough etiquette.<br>• A respiratory hygiene / cough etiquette programme should be:<br>- Used with any patients and accompanying persons with undiagnosed transmissible respiratory infections; and<br>- Applied to those with cough, congestion, rhinorrhea, or increased production of respiratory secretions when entering a healthcare facility.<br>• Elements of a respiratory hygiene / cough etiquette programme are: |

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| | - Educate healthcare facility staff, patients and visitors;<br>- Source control measures such as covering the mouth / nose with a tissue when coughing and prompt disposal of used tissues;<br>- Use surgical masks on the coughing person;<br>- Ensure hand hygiene after contact with respiratory secretions; and<br>- Spatial separation, ideally more than one metre, of persons with respiratory infections in common waiting areas when possible. |
| Administrative Controls | • Education and training on hazards and effects as well as safe work practices. |
| Personal Protective Equipment | • Use surgical masks (fluid resistant).<br>• Use impervious gowns.<br>• Use gloves.<br>• Ensure eye protection such as face shields/goggles/safety spectacles/visors where splashes are possible.<br>• Wear rubber boots or plastic overshoes where the flooring/ ground is likely to be contaminated. |

5.2.4 Airborne Infections

Airborne infections are transmitted when the infectious aerosols (such as airborne droplet nuclei or small particles) are small enough to remain airborne for a longer time and distance. Microorganisms can be carried by air currents and be dispersed over longer distances and infect individuals who are not in the vicinity of infected individuals. Such infections include Mycobacterium tuberculosis (TB), rubeola virus (measles) and varicella zoster (chickenpox). Variola (smallpox) can also be transmitted by this route under certain conditions.

Limited airborne transmission of SARSCoV, SARS CoV 2, influenza, rhinovirus, norovirus and rotavirus has also been demonstrated.

Healthcare workers can become infected when they inhale the infectious particles.

Exposure Situations

- High risk situations where there is aerosolisation of patient's respiratory secretions such as endotracheal intubation, bronchoscopy, sputum induction, performance of laryngeal swabs, cough induction by chest physiotherapy, cardiopulmonary resuscitation, surgical procedures and autopsy etc.
- Caring for infective patients such as individuals with infections such as SARS, TB, influenza.
- Outpatient clinics, physicians' offices.
- Emergency departments.
- Respiratory and infectious disease departments.
- Aerosolisation of infected laboratory samples.
- Performing post mortems of infected patients.

- Dental procedures.

Workers at Risk

- Healthcare workers in direct patient care particularly departments of respiratory medicine, infectious diseases and emergency care, and areas involving care of immunocompromised patients.
- Emergency room staff.
- Surgical staff.
- Clinical and research laboratory workers.
- Biological waste handlers including cleaners.
- Housekeeping staff.
- Mortuary workers and autopsy room staff, particularly if using an oscillating saw.
- Dental healthcare workers including dentists, assistants and technicians.
- Ambulance crew.

Table 17: Examples of control measures to reduce exposure (Airborne infections).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Ventilation design.<br>• Laminar flow.<br>• Use High Efficiency Particulate Air (HEPA) filters.<br>• Use biological safety cabinets in the laboratory when performing aerosol generating tests.<br>• Use airborne infection isolation rooms [AIIR] (negative pressure to the atmosphere); a single room is preferable.<br>• In airborne infection isolation rooms (AIIR):<br>- Ensure that the air pressure is checked visually daily with the use of smoke tubes or flutter strips; and<br>- At least 12 air changes per hour (new facility) or 6 air changes per hour (old / existing facilities).<br>• During resuscitation, use of mouthpieces, pocket resuscitation masks with one-way valves, and other ventilation devices. |
| Safe Work Practices | • Maintain proper hand hygiene between contact with patients.<br>• Adhere to the proper sequence of PPE removal.<br>• Use standard precautions:<br>- In waiting rooms, separate infectious patients such as those with cough or sneezing in a separate enclosed room away from others; and<br>- Maintain a distance of at least one metre between symptomatic and non-symptomatic patients in the waiting room.<br>• Implement a respiratory hygiene/cough etiquette programme which should be:<br>- Used with any patients and accompanying persons with undiagnosed transmissible respiratory infections; and<br>- Applied to those with cough, congestion, rhinorrhea, or increased production of respiratory secretions when entering a healthcare facility. |

| | |
|---|---|
| | • Elements of a respiratory hygiene / cough etiquette programme are:<br>- Educate healthcare facility staff, patients and visitors;<br>- Source control measures such as covering the mouth / nose with a tissue when coughing and prompt disposal of used tissues;<br>- Use surgical masks on the coughing person;<br>- Ensure hand hygiene after contact with respiratory secretions; and<br>- Spatial separation, ideally more than one metre, of persons with respiratory infections in common waiting areas when possible.<br>• Safety equipment:<br>- Biological safety cabinets should be used for laboratory work where necessary; and<br>- Type and specifications of such cabinets would depend on the risk level of the microbiological agents and procedure being performed. |
| Administrative Controls | • Education and training on hazards and effects as well as safe work practices. |
| Personal Protective Equipment | • Fit-tested particulate respirator N95 or higher;<br>• Appropriate eye protection such as safety goggles or face shields depending on the risk.<br>• Use impervious aprons.<br>• Use appropriate gloves.<br>• Wear rubber boots or plastic overshoes where the flooring/ground is likely to be contaminated. |

5.2.5 Infections Transmitted by Direct Contact

Healthcare workers can become infected when they come into direct contact with blood, bodily fluids and body parts; respiratory secretions and excretions of patients; excreta such as faeces, urine and vomit; and direct skin contact with infected patients.

Infections transmitted by direct contact include gastrointestinal infections such as Salmonella typhi, Norovirus, E. coli O157, Clostridium difficile, Campylobacter jejuni, Hepatitis A; skin and soft tissue infections such as Staphylococcus aureus, Methicillin resistant Staphylococcus aureus (MRSA), ringworm, scabies (mites), herpes simplex virus (HSV); and viral respiratory tract infections such as respiratory syncytial virus (RSV).

Exposure Situations

*Caring for infectious patients without using proper precautions in:*

- Wards;
- Outpatient clinics or physicians' offices;

- Emergency departments;
- Operating theatres; and
- Dental procedures.

*Not using proper precautions in the following situations:*
- Performing post mortems of infected patients;
- Maintenance of contaminated biomedical equipment;
- Clinical and research laboratories;
- Housekeeping and laundry; and
- Waste handling and disposal.

Workers at Risk
- Healthcare workers caring for infectious patients.
- Dental healthcare staff such as dentists, dental nurses and assistants.
- Operating theatre staff.
- Clinical and research laboratory staff.
- Housekeeping staff.
- Waste handling and disposal staff.
- Biomedical technicians and engineers.

Table 18: Examples of control measures to reduce exposure (Direct contact).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Isolate patients in a single room where possible.<br>• Use of disposable protective sheaths/sleeves for patient care devices where appropriate.<br>• During resuscitation, use a mouthpiece, pocket resuscitation masks with one-way valves, and other ventilation devices |
| Safe Work Practices | • Use standard precautions.<br>• Ensure proper hand hygiene after contact with each patient.<br>• Keep nails short and discourage use of artificial nails.<br>• When nursing a patient on contact precautions, put on PPE on entry to the room.<br>• Adhere to the proper sequence of PPE removal.<br>• When removing PPE, gloves should be removed last.<br>• Hand hygiene should be performed after removing the gloves.<br>• Segregate used disposable and non-disposable PPE.<br>• Label bags of used PPE properly.<br>• Contain and dispose contaminated waste and PPE properly.<br>• Wash laboratory coats separately from other clothes, and ideally they should not be brought home.<br>• Clean and disinfect biomedical equipment such as endoscopes, surgical instruments, patient care equipment like thermometers and glucose monitoring devices properly.<br>• Clean and disinfect shared toys between patient use (in paediatrics) properly. |

| | |
|---|---|
| | • Maintain a distance of at least one metre between symptomatic and non-symptomatic patients in the waiting room. |
| Administrative Controls | • Education and training on hazards and effects as well as safe work practices. |
| Personal Protective Equipment | • Use appropriate eye protection such as safety goggles or face shields.<br>• Use impervious aprons.<br>• Wear appropriate gloves.<br>• Wear rubber boots or plastic overshoes where the flooring/ground is likely to be contaminated |

5.2.6 Biological Matter

Exposure to certain animal proteins and vegetable matter can cause allergies, dermatitis and occupational asthma.

Vegetable Matter

Workers exposed to vegetable matter such as wheat, soybean, buckwheat and other cereal flours, raw cotton fibres and other vegetable proteins can develop asthma or dermatitis. In the healthcare setting, this might occur in the kitchens and animal research facilities. The organisation should assess the exposure risk and implement control measures such as improved ventilation, local exhaust ventilation, safe work practices and use of appropriate PPE.

*Mode of Exposure*
Workers are exposed to vegetable matter through direct contact or by inhalation.

*Exposure Situations*
- Use of cereal flours in food preparation such as sifting or addition of flour.
- Transfer animal feed to smaller containers.

*Workers at Risk*
- Kitchen aides and cooks; and
- Animal husbandry workers.

Table 19: Examples of control measures to reduce exposure (Vegetable matter).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Consider enclosing the weighing and sifting process.<br>• Automate the sifting process.<br>• Use local exhaust ventilation together with enclosure for sifting process. |
| Safe Work Practices | • Transfer flour or animal feed in such a way to minimise generation of dust. |

| | |
|---|---|
| | • Wet cleaning of dusty areas.<br>• Implement a Respiratory Protection Programme if respirators are used. |
| Personal Protective Equipment | • Use appropriate respirators, fit-tested if necessary.<br>• Wear apron.<br>• Wear non-slip shoes;<br>• Wear gloves. |

Animal Proteins

Researchers and veterinary workers who handle animals may develop occupational asthma or dermatitis due to inhalation of or direct contact with animal proteins found in fur, dried secretions and excreta of animal. In the kitchens, employees can be exposed to animal proteins as they handle fish and meat in food preparation.

*Exposure Situations*
- Handle animals in animal research facilities;
- Use cell lines in research laboratories;
- Use animal tissues/parts in research laboratories;
- Handle various meats in food preparation; and
- Work in biomedical research facilities.

*Workers at Risk*
- Animal husbandry workers;
- Animal researchers;
- Biomedical researchers; and
- Kitchen workers.

Table 20: Examples of control measures to reduce exposure (Animal proteins).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Ensure proper ventilation, air flow and sufficient air exchange.<br>• Provide Local Exhaust Ventilation (LEV) and well-designed ventilation in animal housing areas.<br>• Use biological safety cabinets where appropriate. |
| Safe Work Practices | • Practise standard precautions.<br>• Cover all open wounds with waterproof plaster.<br>• Use PPE and laboratory coats should not be worn outside the working areas.<br>• Implement a Respiratory Protection Programme if respirators are used. |
| Administrative Controls | • Educate and raise awareness amongst staff. |
| Personal Protective Equipment | • Use respirators where appropriate (fit-tested).<br>• Wear eye protection.<br>• Wear gloves.<br>• Use impervious aprons. |

| | |
|---|---|
| | • Wear appropriate shoes. |

Further information can be obtained from:

- HSE, UK: Biological agents: Managing the risks in laboratories and healthcare premises
- World Health Organisation (WHO): Laboratory Biosafety Manual 3rd edition
- MOH: Guidelines for Preventing Transmission of Bloodborne Infections in a Healthcare Setting
- CDC, USA: Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings
- CDC, USA: Guidelines for Infection Control in Dental Healthcare Settings

**5.3 Physical Hazards**

5.3.1 Falls from Heights

Falling from height is one of the major causes of fatalities and injuries in the workplace, including the healthcare industry. Especially for smaller establishments such as private general practitioner (GP) clinics and optical retail shops where space is a constraint, storage cupboards are usually built right up to the ceiling. These workplaces should be equipped with ladders or stable step stools so that employees can access heights safely. The safe use of ladders is important to ensure that employees are protected from the risk of falling from heights.

Some good work practices when working with ladders:

- Use the right ladder for the job;
- Place the ladder on stable and level ground;
- Wear proper footwear e.g. non-slip flat shoes;
- Maintain three points of contact with the ladder at all times; and
- Do not work on the top rung of the ladder.

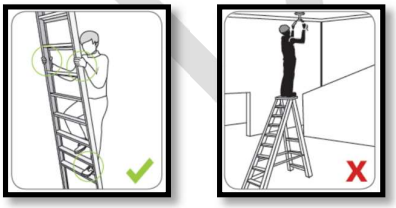

Figure 3 (a): Always maintain three-point contact with the ladder at all times.
Figure 3 (b): Do not work on the top rung of the ladder.

5.3.2 Slips, Trips and Falls

Slippery or uneven surfaces are commonly observed workplace hazards in healthcare facilities. Other conditions that can also contribute to slips, trips and falls include

insufficient lighting, poor housekeeping, spills, wet and slippery flooring and lack of proper handholds.

Some preventive measures for slips and trips are:

- Clean up spills immediately;
- Erect signs to warn users about slippery floors during and after cleaning;
- Provide and ensure the usage of proper footwear such as anti-slip shoes;
- Practise good housekeeping;
- Keep floors and stairs dry and clean;
- Use anti-slip mats in areas that are often wet or slippery e.g. shower facilities; and
- Keep walkways free of obstruction.

### 5.3.3 Ergonomics

Ergonomics is the science of fitting the job to the worker, the design of equipment and work tasks to match to the capability of the worker. Musculoskeletal disorders can result from a mismatch between the capabilities of the workers, the equipment and the work task. Having well-designed work environment and work practices can prevent injuries before they occur.

Many tasks in a healthcare setting involved manual handling such as transferring, lifting of patients/residents and transportation of equipment and supplies.

Increased risk of injuries can occur from manual handling tasks when:

- movements are repetitive e.g., frequent re-stocking of supplies onto shelves;
- tasks are done in awkward postures e.g., reaching across beds to lift patients/residents;
- tasks involves forceful exertion e.g. pushing chairs and heavy trolleys.

Other risk factors include:

- Overexertion e.g. trying to stop a patient/resident from falling;
- Multiple lifts per shift;
- Lifting alone with no available staff to help;
- Lifting patients/residents who cannot support their own weight or who are overweight;
- Working beyond one's physical capabilities;
- Poor techniques during manual handling such as;
  - Twisting of the back or neck;
  - Excessive bending – lateral or side bending, bending over to reach load;
  - Reaching above shoulder height;
- Prolonged static awkward postures can also increase risk of musculoskeletal disorders. The use of inappropriately designed equipment or tools can contribute to the development of musculoskeletal disorders as they may require the worker to adopt awkward postures when using them.

Control Measures

*Handling, Lifting or Transferring Patients*

Mechanical lifting equipment such as overhead wall-mounted lifters /ceiling hoist/ mobile hoists may be used to reduce the physical exertion of lifting patients/residents.

Transfer devices such as transfer board, draw sheets and transfer belts may also be used to reduce the physical exertion during manual handling of patients/residents.

Equipment such as wheelchairs and trolleys should be well maintained to reduce forceful exertion when using them.

Wheelchairs with removable armrests and footrests may allow for easier lateral transfers of patients/residents.

Adopt proper lifting/transfer techniques safe manual handling of patients/residents or loads:

- Ensure a good base of support;
- Loads should be close to the body;
- Avoid awkward postures such as excessive bending or twisting of trunks
- Employees should be trained on safe manual handling techniques
- Limit the number of allowed lifts per employee per day;
- Get assistance or use mechanical lifting devices such as hoists where possible:
- Provide training on when and how to use mechanical devices.

*Transferring or moving items or objects*

- Place equipment on a rolling device if possible to allow for easier transport, or have wheels attached to the equipment;
- Push rather than pull equipment when possible.
- Get help when moving heavy or bulky equipment and ensure unobstructed line of vision
- Ensure that passageways are unobstructed;
- Use the attached handles when they are available to help with the transfer process; and
- Do not transport multiple items alone.

In the event that the lifting aids/equipment are not available and/or not suitable for use while performing the tasks, employees should be encouraged to seek assistance from their co-workers.

*Reaching and Lifting Tasks*

Limit excessive reaching and back flexion when reaching into deep sinks or containers by:

- Placing an object such as a plastic basin in the bottom of the sink to raise the surface up while washing items in the sink; or
- Removing objects to be washed into a smaller container on the counter for scrubbing or soaking and replacing back in the sink for final rinse.

Limit reaching or lifting hazards when lifting trash, laundry or other kinds of bags by:

- Use carts with side opening for easy disposal of garbage/laundry bags without having to reach to pull the bags out;
- Limiting the size and weight of these bags;
- Placing receptacles in unobstructed and easy to reach places;
- Installing chutes and dumpsters at or below grade level; and
- Using spring-loaded platforms to help lift items such as laundry, keeping work at a comfortable uniform level.

Limit reaching and pushing hazards from moving heavy dietary, laundry, housekeeping or other carts by:

- Keeping equipment such carts and trolleys well maintained to minimise the amount of force exerted while using them;
- Using carts with large, low rolling resistance wheels. These can usually roll easily over mixed flooring as well as gaps between elevators and hallways;
- Keeping handles of devices to be pushed between waist to chest height;
- Pushing rather than pulling whenever possible;
- Getting help with heavy or bulky loads; and
- Keeping passageways unobstructed and well maintained.

*Housekeeping Tasks*

Employees can reduce ergonomic hazards during housekeeping by:

- Using carts to transport supplies rather than carrying;
- Avoiding awkward postures while cleaning (e.g. twisting and bending);
- Alternating tasks or rotating employees to perform different tasks;
- Using padded non-slip handles where possible.

*Hand tools*

Reduce the risks of strains and sprains of the wrists, arms, and shoulders by choosing hand tools carefully. Hand tools should:

- Be well-designed and fit to the users;
- Have padded non-slip handles where possible;
- Allow the users' wrists to remain in neutral (non-awkward) positions while in use;
- Have minimal tool weight; and
- Have minimal vibration or use vibration dampening devices and vibration-dampening gloves.

Ergonomics Programme

An ergonomics programme provides a systematic approach for organisations to manage ergonomic risk factors and issues at the workplace. The establishment of the programme allows the organisation to make better informed choices and help create a healthy and safety culture that promotes good ergonomics at work.

The key elements in an ergonomics programme include:

- Management commitment and policy;
- Employee involvement;

- Training and education;
- Hazard identification and risk assessment;
- Workplace monitoring, reporting and medical management;
- Implementation of control measures; and
- Evaluation and review.

Further information can be obtained from:

- Singapore Standard SS 514 : 2016 Code of practice for office ergonomics
- Singapore Standard SS 569 : 2011 Code of practice for manual handling
- WSH Guidelines on Improving Ergonomics in the Workplace
- Code of Practice on Risk Management, Third Revision

5.3.4 Noise

In a healthcare facility, excessive noise levels can be encountered in compressor rooms, workshops, laundry areas, orthotics, plaster rooms and dental centres / clinics.

Permissible exposure limits for noise are expressed in decibel of A-weighted sound pressure level (dBA). Decibel of A-weighted sound pressure level is the reading obtained from a sound level meter or dosimeter and it reflects the response of the human ear to noise.

Prolonged exposure to excessive noise can cause noise-induced hearing loss (NIHL) or noise-induced deafness (NID). Other detrimental effects of excessive noise exposure include tinnitus, acoustic trauma, interference with speech communication and with perception of warning signs, disruption of job performance, annoyance and extra-auditory effects.

Healthcare personnel at risk include workshop technicians, laundry staff, facilities management staff, nurses and doctors / dentists working in orthotics, plaster rooms and dental centres / clinics.

Employees are deemed to be exposed to excessive noise if the noise they are exposed to exceeds:

- The permissible exposure limits stipulated in the Schedule of WSH (Noise) Regulations 2011;
- An equivalent sound pressure level of 85 dB(A) over an 8-hour work day;
- Peak sound pressure level exceeding 140 dB(C)

Table 21: Examples of control measures to reduce exposure (Noise).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Elimination / Substitution | • Replace metal-to-metal contact with synthetic material-to-metal contact. |
| Engineering Controls | • Provide enclosures with acoustical foam lining for noisy compressors and equipment.<br>• Acoustical treatment of walls to reduce noise reflection.<br>• Apply vibration damping to noisy machines using springs or elastomers. |
| Administrative Controls | • Limit persons' exposure time to excessive noise through job rotation. |

| | |
|---|---|
| Personal Protective Equipment | • Provide suitable hearing protectors to all persons exposed to excessive noise and ensuring their proper usage. |

Employers should establish an effective Hearing Conservation Programme (HCP) to manage the noise hazard if their employees are exposed to excessive noise.

The hearing conservation programme should include:

- Identification of noise hazard and evaluation of the risks involved by conducting a noise monitoring to identify employees who may be exposed to excessive noise so that their exposures can be assessed. The monitoring report must be submitted to the MOM;
- Implementation of reasonably practicable noise control measures to reduce or control the noise from machinery or equipment used.
- Provision of suitable hearing protectors to all persons exposed to excessive noise and ensuring their proper usage;
- Training and educating all persons involved in HCP, including management, HCP team members and all employees who are exposed to excessive noise, to increase their awareness of noise hazards and their prevention; The HCP training should be carried out annually for employees exposed to excessive noise and within three months of job commencement for new employees in noisy work environment.
- Conducting pre-placement and annual audiometric examinations for employees exposed to excessive noise by a Designated Workplace Doctor (DWD) for detection of early hearing impairment and assessment of their fitness to work in a noisy environment. The results must be submitted to the MOM;
- Keeping records and documenting the measures taken to protect employees from noise; and
- Regular evaluation of HCP to determine its effectiveness and areas for improvements.

NID is a notifiable and compensable occupational disease. The MOM must be notified for employees diagnosed with NID.

Further information can be obtained from:

- Workplace Safety and Health (Noise) Regulations 2011
- Workplace Safety and Health (Medical Examinations) Regulations, 2011
- Workplace Safety and Health (Incident Reporting) Regulations
- Work Injury Compensation Act, 2019
- Singapore Standard SS 657: 2020 Code of practice for workplace noise control
- WSH Council: WSH Guidelines on Hearing Conservation Programme

5.3.5 Vibration

Noisy processes are often associated with vibration. Intense vibration may be transmitted to persons who operate certain vehicles, equipment (e.g. grinders and cutters in prosthesis workshop) and hand held tools (e.g. dental ultrasonic scalers and vibrators, bone drills / saws in operating theatres).

Where persons are exposed to whole body or hand-arm vibration, the exposure must be controlled and reduced to as low as reasonably practicable to protect them from adverse health effects.

Healthcare personnel at risk include workshop technicians, dentists, doctors and nurses working in orthotics, plaster rooms, operating theatres and dental centres / clinics and cleaners.

Table 22: Examples of control measures to reduce exposure (Vibration).

| Control Approach | Examples of Control Measures |
|---|---|
| Elimination / Substitution | • Procure low vibration equipment and tools in replacement of high-vibration ones. |
| Safe Work Practices | • Ensure all equipment and hand tools are maintained in good condition |
| Administrative Controls | • Design work breaks to avoid long periods of vibration exposure.<br>• Provide information and training to affected personnel on the hazard, signs of injury and ways to minimise risk and report any symptoms. |

Further information can be obtained from:

- Workplace Safety and Health (Noise) Regulations 2011
- WSH Council: WSH Guidelines on Hearing Conservation Programme
- Singapore Standard SS 657 : 2020 Code of practice for workplace noise control
- American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values for hand-arm vibration exposure and whole-body vibration exposure.
- Canadian Centre for Occupational Health and Safety. OSH Answers Fact Sheets: Vibration - Measurement, Control and Standards.
- https://www.ccohs.ca/oshanswers/phys_agents/vibration/vibration_measure.html
- Health and Safety Executive (UK): Hand-arm vibration at work: A brief guide. https://www.hse.gov.uk/pubns/indg175.htm

5.3.6 Ionising Radiation

The Radiation Protection Act and its subsidiary legislation on ionising radiation covers radioactive materials and ionising radiation generating apparatus used in the healthcare industry. The radioactive wastes generated are also governed by these legislations.

To own and to use the radioactive materials and the apparatus, healthcare establishments need to apply for the appropriate licences from the Radiation Protection & Nuclear Science Department (RPNSD), National Environment Agency (NEA).

Radiation Exposure in Healthcare

Healthcare employees may be exposed to ionising radiation from portable and fixed X-ray machines, radioactive materials used in nuclear medicine and other ionising radiation generating devices. The effects of radiation exposure include the following.

- Deterministic effects
  - Erythema and dermatitis
  - Cataract
  - Bone marrow suppression
  - Temporary or permanent sterilisation

- Large whole-body exposures cause:
  - Nausea;
  - Vomiting;
  - Diarrhoea;
  - Weakness; and
  - Death.

- Stochastic effects
  - - Genetic effects may lead to congenital defects in the employee's offspring (i.e. hereditary effects).

Exposure to radiation can occur in the following situations.

- Unprotected employees, bystanders and members of the public who are near an irradiating machine in operation or radionuclide sources. The amount of exposure depends on the amount of radiation, duration of exposure, distance from the source and type of shielding in place.
- Employees can be exposed to radioactive isotopes or specimens and excreta of humans and animals who have received radioisotopes.
- Exposure may come from patients undergoing nuclear medicine procedures.
- Exposure may also result from handling of radioactive spills.
- Badly maintained machinery and improperly designed facility / room.
- Spent sources of radioactive materials or contaminated materials which are not properly stored or handled.

Exposure Monitoring

- Thermoluminescent dosimetry badges or their equivalent should be used for long-term monitoring of personnel;
- Radiation monitoring equipment should be used to monitor the working environment;
- Appropriate personnel monitoring equipment, such as film badges, pocket chambers, pocket dosimeters, or film rings, should be used to monitor healthcare workers who may be exposed to radiation hazards; and

- Records of the radiation exposure of the employees should be kept and the employee should be advised of his individual exposures as according to licensing conditions.

Table 23: Examples of control measures to reduce exposure (Radiation).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Elimination/ Substitution | • Consider X-ray machines that can operate with a smaller electric current when buying new X-ray machines.<br>• Use advanced (digital) screen/material so that X-ray operating at a smaller electric current can still give the same picture quality. |
| Engineering Controls | • Operate the X-ray and other (portable) irradiation devices with adequate shielding in accordance with the Radiation Protection Act and Regulations.<br>• Procedures that use remote fluoroscopy could be run from control panels in an adjacent room, shielded from radiation exposure.<br>• Use lead glass as a barrier to protect against radiation exposure when procedures must be done close to the patient.<br>• Use lead strips during fluoroscopic procedures.<br>• Provide lead shields for syringes or vials containing radioisotopes. |
| Safe Work Practices | • Give adequate warning to surrounding staff or members of the public before operating X-ray machines.<br>• Establish a preventive and corrective maintenance programme for X-ray machines with specific personnel responsible for assuring proper maintenance of the X-ray machines.<br>• Establish a contamination monitoring plan for all work areas where radioactive materials are used, handled or stored.<br>• Implement SWP for cleaning up of contaminated work areas.<br>• Provide a separate storage area for radioactive sources. This area should be adequately shielded. Only authorised personnel should have access to such a storage area.<br>• Provide proper cleaning agents for cleaning of work areas and hands. |
| Administrative Controls | • Obtain appropriate licenses to own irradiating apparatus and radioactive materials.<br>• To operate an irradiation apparatus, appropriate licences need to be obtained from the regulatory authority. These licences are only issued to qualified medical practitioners who have the necessary knowledge on the safe use of these apparatus.<br>• To use radioactive materials (for medical purposes), appropriate licences need to be obtained from the regulatory authority. These licences are only issued to qualified / relevant |

| | |
|---|---|
| | medical practitioners who have the necessary knowledge on the safe use of these materials.<br>• Establish guidelines to manage patients who are undergoing nuclear medicine procedures.<br>• Document and retain inventories of radioactive materials. |
| Personal Protective Equipment | • Provision of proper PPE e.g. leads aprons, lead gloves, thyroid shields and lead goggles. |

Radioactive Waste Management

Unusable radioactive materials and articles / things contaminated by radioactive materials are generally considered radioactive waste. Radiation protection legislations do not allow such waste to be disposed off or accumulated without the approval of the Director- General for Environment Protection.

Two main types of radioactive waste can be found in healthcare establishments:

- Low level radioactive waste (solid and liquid); and
- Spent sealed sources (solid).

Disposal of radioactive waste from any healthcare establishment requires approval from the establishment's internal committee or officer responsible for radiation safety. In addition, written consent from RPNSD is needed before the disposal can be carried out.

Healthcare establishments are advised to consult RPNSD on matters relating to the disposal of such waste.

Table 24: Examples of control measures to reduce exposure (Radioactive waste).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Safe Work Practices | • Prepare a separate storage area for radioactive waste and the area should be adequately shielded. |
| Administrative Controls | • Healthcare establishments should establish a safety committee or appoint a radiation safety officer to be responsible for the disposal of radioactive waste.<br>• Only authorised personnel should have access to such storage areas. |

Further information can be obtained from:

- Radiation Protection Act 2007
- Radiation Protection (Ionising Radiation) Regulations
- National Environment Agency, Singapore Radiation Protection
- European Commission Nuclear energy – Radiation protection
- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Radiation Health Series

- US Department of Energy (DOE), Office of Environment Health, Safety & Security, Nuclear safety, policy, guidance & reports
- International Commission on Radiological Protection (ICRP)
- International Atomic Energy Agency
- National Council on Radiation Protection & Measurements (NCRP)
- United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

5.3.7 Non-ionising Radiation

The Radiation Protection Act and subsidiary legislation on non-ionising radiation apply to the following types of medical irradiating devices:

- High power lasers;
- Medical ultrasound apparatus;
- Magnetic Resonance Imaging (MRI) apparatus; and
- Ultraviolet sunlamps.

Healthcare establishments need to obtain the appropriate licences to own and/or to operate irradiating apparatus.

Laser

A laser is a device that emits intense coherent light through a special mechanism called stimulated emission. As a light source, a laser can have various properties, depending on the purpose for which it is designed and calibrated.

The four classes of lasers are:

*Class I* – Least-hazardous class, it is considered incapable of providing damaging levels of laser emissions. Used in laser printers and compact disc players.

*Class II* – Applies only to visible laser emissions and may be viewed directly for time periods of less than or equal to 0.25 seconds, which is the aversion response time. Some laser pointers and laser barcode scanners belong to this class. Continuous lasers in this class operate at a power of less than 0.001 W.

*Class IIIa* – Dangerous under direct or reflected vision, this class includes lasers that emit both invisible and visible electromagnetic spectrum. Many laser pointers belong to this class. Continuous lasers in this class operate at a power in the range 0.001 – 0.005 W.

*Class IIIb* – Considered as a high-power laser, this class may extend across the whole electromagnetic spectrum and are hazardous when viewed intrabeam. Lasers in this class are used in physiotherapy treatments and for research purposes. Continuous lasers in this class operate at a power of less
than 0.5 W.

*Class IV* – This class of laser has the highest energy. It also extends across the whole electromagnetic spectrum. It presents significant fire, skin, and eye hazards. Class 4 lasers are used for laser displays, laser surgery and cutting metals.

Exposure to Lasers in Healthcare

Exposure of healthcare workers to lasers can occur in the operating rooms during excision and cauterisation of tissues, where Class IIIb and Class IV lasers are most often used. Exposure usually occurs from unintentional operation and/or when proper controls are not in effect. Direct beam exposure can cause burns to the skin and eyes, resulting in possibly blindness. The electric current used to generate the beam is a potential shock hazard. Fire is another major concern when using lasers.

Laser beam should be kept away from any flammable liquid, gases or any flammable object that can emit flammable vapour.

Table 25: Examples of control measures to reduce exposure (Lasers).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Use portable smoke evacuators and room suction systems.<br>• Insulate/ground laser systems adequately, especially those with high voltage capacitance.<br>• Attach bleeders and proper grounding to the system.<br>• All doors to operating rooms that house lasers should contain safety interlocks which shutdown the laser system if anyone enters the room.<br>• Cover or black out, all windows in laser surgical areas to protect employees outside the surgical area. |
| Safe Work Practices | • Establish a preventive and corrective maintenance programme for laser machines with specific personnel responsible for assuring proper maintenance of this equipment. Only qualified personnel (with the appropriate licences) should maintain the system. Maintenance may only be done according to written standard operating procedures.<br>• Laser operators should check the laser system before each procedure and during extended procedures. Classifications of lasers should coincide with actual power output. Generally, power measurement is required when the manufacturer's information is not available, if the laser system has not been classified, or if alterations have been made to the laser system that may have changed its classification. Only personnel trained in laser technology should make measurements. |
| Administrative Controls | • Ensure all personnel using such equipment are trained in the proper usage. Only personnel with the appropriate |

| | |
|---|---|
| | licence are allowed to use Class IIIb and Class IV laser devices.<br>• Provide warning signs in areas where exposure to lasers is likely. |
| Personal Protective Equipment | • Provide proper PPE, e.g. protective clothing (laboratory jacket or coat can provide protection for the arms. For Class IV lasers, consideration should be given to flame resistant materials), gloves (tightly woven fabrics and opaque gloves provide the best protection) and laser protective eyewear (wavelength of the laser is the most important factor in determining the type of eye protection to be used).<br>• Provide skin covers and/or "sun screen" creams is recommended for ultraviolet lasers (200-400nm). |

Further information can be obtained from:

- Radiation Protection Act 2007
- Radiation Protection (Non-Ionising Radiation) Regulations

Exposure to Laser Plume in Healthcare

During surgical procedures that use a laser or electro-surgical unit, the thermal destruction of tissue creates smoke as a by-product. Consequently, healthcare workers may be exposed to laser or electro-surgical smoke.

*Potential Hazards*

Research has shown that the laser smoke plume can contain toxic gases and vapours such as benzene, hydrogen cyanide, and formaldehyde, bio-aerosols, dead and live cellular material (including blood fragments), and viruses.

At high concentrations the smoke causes ocular and upper respiratory tract irritation in healthcare workers and creates visual problems for the surgeon. The smoke has unpleasant odours and has been shown to have mutagenic potential. Although there has been no documented transmission of infectious disease through surgical smoke, the potential to generate infectious viral fragments, particularly following treatment of venereal warts, may exist. The smoke may act as a vector for cancerous cells which may be inhaled by the surgical team and other exposed individuals. Note that the laser beam may ignite the plume or biological vapours.

Table 26: Examples of control measures to reduce exposure (Laser plume).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Use portable smoke evacuators and room suction systems. |
| Safe Work Practices | • Keep the smoke evacuator or room suction hose nozzle inlet as close as possible (within one diameter of the suction hose) to the surgical site to effectively capture airborne contaminants. |

| | |
|---|---|
| | • Keep smoke evacuator switched on (activated) at all times when airborne particles are produced during all surgical or other procedures.<br>• Consider all tubing, filter, and absorbers as infectious waste and dispose of them appropriately.<br>• Install new filters and tubing before each procedure.<br>• Inspect smoke evacuator systems regularly to prevent possible leaks.<br>• Practise Standard Precautions[2]. |
| Personal Protective Equipment | • Provide proper PPE e.g. gloves and laser protective eyewear. |

Further information can be obtained from:

- CDC, NIOSH: Hazard Controls - Control of Smoke from Laser / Electric Surgical Procedures
- AMERICAN SOCIETY FOR LASER MEDICINE AND SURGERY, INC.ASLMS Laser and Energy Device Plume Position Statement.
- Canadian Centre for Occupational Health and Safety. OSH Answers Fact Sheets: Laser Plumes - Health Care.

Medical Ultrasound

Medical ultrasound apparatus are used for diagnostic, therapeutic and surgery purposes. They emit ultrasound at acoustic frequencies above 16 kHz.

Since these apparatus are electrical devices, care must be taken to avoid any possible electrical incidents.

The recommended permissible exposure limit for ultrasound exposure is provided in SS 567:2020 Code of practice on workplace noise control for reference to prevent personnel from being exposed to excessive level.

Table 27: Examples of control measures to reduce exposure (Ultrasound).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Safe Work Practices | • Implement an inspection plan to detect any possible wear and tear which exposes any current conducting part on the apparatus.<br>• Put in place quality control procedures and testing programme to ensure apparatus performance specifications are met. |

[2] Standard Precautions are based on the principle that all blood, body fluids, secretions, excretions except sweat, nonintact skin, and mucus membranes may contain transmissible infectious agents. Standard Precautions include a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered.*

For more details on Standard Precautions, refer to the "Guidelines for Preventing Transmission of Bloodborne Infections in a Healthcare Setting", published by the Ministry of Health (MOH) Singapore.

* Excerpt from CDC: Guideline for Isolation Precautions 2007. http://www.cdc.gov/hicpac/2007ip/2007ip_part3.html

| | |
|---|---|
| Administrative Controls | • Only qualified personnel are allowed to operate the apparatus.<br>• A licence is needed to possess/own such apparatus. |

Further information can be obtained from:

- Radiation Protection Act 2007
- Radiation Protection (Non-Ionising Radiation) Regulations
- Academy of Medicine, Singapore: Guidelines on the Use of Ultrasound in Medicine
  SS 567:2020 Code of practice on workplace noise control

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) apparatus emit strong magnetic fields and radiofrequency radiation for the purpose of imaging or spectroscopy of the human body.

Strong magnetic fields may have harmful effect on the human body. In addition, strong magnetic fields may propel small objects and lead to physical injury if there is no proper shielding. Since this apparatus is an electrical device, care must be taken to avoid any possible electrical incidents.

Table 28: Examples of control measures to reduce exposure (MRI).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Safe Work Practices | • Implement an inspection plan to detect any possible wear and tear which exposes any current conducting part on the apparatus. |
| Administrative Controls | • Only qualified personnel are allowed to operate the apparatus.<br>• A license is needed to possess/own such apparatus;<br>• Install proper warning signs to alert people of the high magnetic field in the vicinity and its dangers.<br>• Install proper warning signs to alert people of the generation of radio frequency radiation. |

Further information can be obtained from:

- Radiation Protection Act 2007
- Radiation Protection (Non-Ionising Radiation) Regulations

Ultraviolet Sunlamps

These are apparatus that emit ultraviolet radiation (λ = 180 – 400 nm) to induce skin tanning or other cosmetic effects. Since these apparatus are electrical devices, care must be taken to avoid any possible electrical incidents.

Table 29: Examples of control measures to reduce exposure (Ultraviolet sunlamps).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Ensure that the appropriate safety features are built into the apparatus. |

| | |
|---|---|
| Safe Work Practices | • Implement an inspection plan to detect any possible wear and tear which exposes any current conducting part on the apparatus.<br>• Put in place quality control procedures and testing programmes to ensure apparatus performance specifications are met. |
| Administrative Controls | • Only qualified personnel are allowed to operate this apparatus;<br>• A license is needed to possess/ own such apparatus; |
| Personal Protective Equipment | • Provision of proper PPE e.g. protective eyewear. |

Further information can be obtained from:

- Radiation Protection Act 2007
- Radiation Protection (Non-Ionising Radiation) Regulations

5.3.8 Sharps

'Sharps' are objects with a thin cutting edge or point that are able to cause injuries such as cuts, lacerations or puncture wounds. These include scalpels and blades, suture and injection needles, knives, machinery and cutting devices and broken glass and porcelain.

Management System

An effective sharps management programme should have the following elements.

*Management Policy and Strategy*

Management support with the provision of clear goals, responsibilities and resources is vital for a successful programme. Involvement of employees is important as they are most familiar with the hazards at the workplace.

*Identification of Hazards*

Areas and processes where there are risks of sharps injuries should be systematically identified from information from incident reports of injury and illness data, workers' compensation claims, near miss investigation reports, insurance company reports, employee interviews, employee surveys and workplace observations.

*Risk Assessment and Risk Control*

The risks should be controlled at source where possible first, and risk control measures implemented to mitigate the risks based on the hierarchy of control.

*Post-Exposure Programme*

In the event that a sharps injury does occur, a post exposure programme should be in place to cope with injured employees who have been exposed to occupational infections, biological matter and chemicals. Treatment given would depend on what the exposure was and address fitness to work.

*Health Surveillance*

Health surveillance system should be in place to monitor work-related ill health due to sharp injuries.

*Prevention*

- Vaccinations
    - Where certain occupational infections due to sharps injuries can be prevented by vaccinations, a vaccination programme should be implemented such as for Hepatitis B. All employees are expected to complete the recommended vaccination programme except for those with medical grounds.
- Case finding, incident reporting and investigation
    - A system should be set up to report and investigate all sharps injuries and near miss events. This system should also ensure that legislative requirements for reporting are met. Investigations outcome and the control measures implemented should also be documented.
- Record-keeping
    - Records of sharps exposures/injuries, interventions and any follow-up should be well kept and maintained. Reporting of any occupational disease that occurs as a result of sharps exposure is required under the current WSH Act.
    - The report should be kept for at least five years or longer where appropriate.
- Education and training
    - All employees should be trained on proper handling of sharps, usage of recommended PPE where appropriate, infection prevention and control policies, vaccinations, post-exposure prophylaxis and reporting procedures for occupational accidents and diseases. The training programme should also ensure that SWP are known and understood by all staff.
- Monitoring and review
    - Information on sharps injuries, mechanism, location, health effects should be analysed by management to ensure that the safety and health policy and procedures remain effective and relevant.

Exposure Situations

- Use of scalpels, blades, suture and injection needles, cutting devices and machinery in:
  - Operating theatres;
  - Wards;
  - Clinics;
  - Pharmacy and drug preparation areas;
  - Radiologic and radiotherapy facilities;
  - Clinical and research laboratories and facilities;
  - Mortuaries; and
  - Waste storage and treatment areas.

- Use of knives, cutting devices and equipment, and machinery in:
  - Kitchens; and
  - Engineering workshops.

- Handling sharps in:
  - Waste storage and treatment areas; and
  - Laundries.

- Handling of broken glass and porcelain by:
  - Nursing staff;
  - Laboratory staff;
  - Housekeeping staff;
  - Kitchen staff;
  - Laboratory staff; and
  - Waste disposal staff.

If the sharp objects are contaminated by either human or animal blood, bodily fluids, secretions and excrement, infections such as hepatitis B, hepatitis C, HIV and other infections could occur.

The sharps could also be contaminated by chemicals such as solvents, disinfectants, cytotoxic and other hazardous drugs, and radioactive material, resulting in adverse health effects.

Workers at Risk:

- Doctors;
- Dentists;
- Nurses;
- Patient care staff;
- Laboratory staff;
- Radiologic and radiotherapy staff;
- Pharmacy and related staff;
- Kitchen staff;
- Housekeeping staff;
- Waste disposal staff; and
- TCM practitioners.

Table 30: Examples of control measures to reduce exposure (Sharps).

| Control Approach | Examples of Control Measures |
|---|---|
| Elimination/Substitution | • Reduce and/or eliminate use of sharps where possible.<br>• Consider alternative methods of medication delivery, e.g. oral, topical etc.<br>• Consider use of blunt-tip suture needles where applicable, e.g. muscle, soft tissue etc.<br>• Consider needleless intravenous delivery systems.<br>• Use an alternative method of food preparation if available. |
| Engineering Controls | • Use guarding for kitchen equipment such as mincers, food mixers, meat slicers and vegetable slicers.<br>• Use sharps with safety features. |
| Safe Work Practices | • In clinical areas:<br>- Avoid recapping of syringes;<br>- If recapping cannot be avoided, use one hand recapping techniques with assistive devices;<br>- Set up instrument trays with uniform orientation of all sharps;<br>- Separate sharp from non-sharp equipment using instruments such as forceps;<br>- Separate used from un-used sharps;<br>- Use forceps to sort and dispose of sharp contaminated devices;<br>- Use labelled puncture proof containers for disposal;<br>- Locate disposal containers close to immediate work area;<br>- Never over fill sharps containers; and<br>- Use containers designed to exclude hands/fingers.<br>• In the operating theatre, in addition to the above:<br>- Use verbal cues before passing sharp instruments;<br>- Use instruments such as receptacle/tray/ container/forceps or other devices to pass sharps; |

| | |
|---|---|
| | - Use forceps/instruments for suturing and not hands; and<br>- Use instruments for retraction of tissues.<br>• In the kitchen and other areas where there are machines:<br>- Ensure safety guards are in place before using the machine;<br>- Do not remove safety guarding or interlocks installed on machines;<br>- Do not reach into moving parts of machines with fingers;<br>- Follow manufacturer's or supplier's instructions when operating the machine;<br>- Clean or maintain the machine only when power has been shut down;<br>- Wash and clean sharp tools separately from other instruments or utensils;<br>- Refrain from wearing loose or frayed clothing;<br>- Kitchens – Knives:<br>▪ Use the right knife for the task at hand;<br>▪ Use a flat surface or cutting board;<br>▪ Ensure that the knife is sharp;<br>▪ Store knives properly in a proper rack in a visible place;<br>▪ Cut away from the body when trimming, deboning or cutting; and<br>▪ Curl the fingers of the other hand over the object that is being cut. |
| Administrative Controls | • Establish a vaccination policy for all healthcare staff against vaccine preventable bloodborne infections.<br>• Implement a prompt post exposure programme for injured healthcare workers. |

| | |
|---|---|
| | • Training and education in safe work practices (standard precautions) at induction for new workers and periodically for all healthcare workers.<br>• Establish an improved reporting system for sharps injuries and their follow-up. |
| Personal Protective Equipment | • Wear mesh gloves when using knives when appropriate.<br>• Use armoured gloves in operating theatres when working with sharp objects. |

Further information can be obtained from:

- WSH Council: WSH Guidelines for the Hospitality and Entertainment Industries
- CDC: Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program
- Canadian Centre for Occupational Health and Safety. OSH Answers Fact Sheets: Needlestick and Sharps Injuries

### 5.4 Psychosocial Hazards

Healthcare workers work in environments that constantly change due to rapid advances in medicine, science and technology and striving to meet the highest standards of patient care and clinical quality. Due to the complex nature of their work, involvement in direct patient care and managing time pressures, healthcare workers are vulnerable to psychosocial threats to their well-being.

The ILO defined psychosocial hazards as the interactions between and among work environment, job content, organisational conditions and workers' capacities, needs, culture, personal extra-job considerations that may through perceptions and experience, influence health, work performance and job satisfaction (ILO, 1986, p3). Some common psychosocial hazards within healthcare include issues related to shift work, overtime work, stress and burnout, workplace harassment and violence, and psychosocial hazard of exposure to infective and environmental hazards. In order to mitigate effects of such hazards, access to counselling or emotional support for work related incidents should be made available to your employees.

The table below summarises the types of psychosocial risk factors and gives some examples.

Table 31: Psychosocial risk factors and examples[3]

| | |
|---|---|
| **Job Content** | Handling multiple demands occurring concurrently, higher uncertainty, lack of variety or short work cycles, fragmented or meaningless work, under use of skills. |
| **Workload and Work Pace** | Work overload, high levels of time pressure, continually subject to deadlines. |
| **Work Schedule** | Shift working, night shifts, inflexible work schedules, unpredictable hours, long or unsociable hours. |
| **Control** | Low participation in decision making, lack of control over workload, pacing, shift work, unpredictable nature of medical healthcare, no control over epidemiology of outbreaks. |
| **Environment and Equipment** | Inadequate equipment availability, suitability or maintenance; poor environmental conditions such as lack of space, poor lighting, excessive noise. |
| **Organisational culture and Function** | Poor communication, low levels of support for problem solving and personal development, lack of definition of, or agreement on, organisational objectives. |
| **Interpersonal Relationships at Work** | Social or physical isolation, poor relationships with superiors, interpersonal conflict, lack of social support, continuous exposure to different people through work, exposure to unreasonable behaviours at work. |

#### 5.4.1 Shift Work, Overtime and Extended Work Hours

[3] Adapted from Stavroula Leka,
Towards the Development of a Psychosocial Risk Management Toolkit (PRIMAT)
The Global Occupational Health Network Newsletter, Issue No. 10 -2006.

*Occurrence*

Shift work, overtime and extended work hours are an inherent part of the healthcare system. Stress and burnout could be a long-term result of shift work and extended work hours. The development of work-related stress is often a result of the complex interplay of multiple psychosocial hazards.

*Effects of Exposure*

*Shift work*

- Disturbance of circadian rhythm (biological clock);
- Sleep deprivation;
- Physical and mental health effects;
- Disruption of family and social life;
- Fatigue and burnout; and
- Increased risk of injuries/accidents.

*Control Measures*

There are two levels at which changes can be made to mitigate the effects of shift work.

Organisational changes

- Shift design and schedules can be adjusted so that staff have sufficient rest days;
- Facilities:
  - A work environment with adequate lighting and ventilation is important for all shifts;
  - Provide rest facilities for all staff;
  - Provision of adequate meal breaks and 'Care Time'[4]
- Training and education on mitigating health and safety effects of shift work and techniques for recognition and reduction of stress.

Staff stress management

- As far as possible, adhere to regular eating patterns and good nutrition;
- Consider sleeping on a set schedule and obtaining sufficient sleep;
- Allow time for relaxation;
- A regular exercise regime is recommended; and
- Continue to engage in social interactions by planning around work

Management of shift work can be dealt with holistically in the programme for work-related stress.

Psychosocial Hazard Management System

[4] Care Time is about taking time to pause at work, no matter how busy you are, to carry out safety checks and health activities. https://www.taketimetotakecare.sg/index.html

The organisation should develop a policy to reduce workers' exposures to work-related stress. Buy-in from senior management is important for the success of the programme.

Programme for managing psychosocial exposures:

- Identify the hazards. The key areas of work that should be assessed include:
    - Demands;
    - Control;
    - Support;
    - Relationships;
    - Roles; and
    - Organisational change.
- Create a system for sensing general psychosocial wellbeing and identify at-risk employees:
    - The sources of collecting such information includes
        - Survey to include questions on emotional/mental wellbeing
        - Feedback from various channels within the organisation
        - Staff absence and sickness records
        - Organisational or department records on areas of high turnovers or critical incidents
        - Staff identified to require escalation of help for counselling or emotional support following workplace related incidents
        - Staff who may highlight to their supervisors/managers concern about one another (as part of a peer support programme)
- Evaluation of Risk and Escalation:
    - After identifying at risk employees, it may be useful to have a system to evaluate the risk. This could be addressed at the level of the Department or work site) and escalation to the appropriate level of authority to address the risk issues.
    - The risk level can be evaluated based on the information in the previous two steps.
    - Focus groups do best when there is a common difficulty to be addressed e.g. when exploring a particular concern within a Department affecting staff wellbeing, or when exploring solutions to a problem and the results communicated to all employees.
- Record findings:
    - An action plan should be developed by both management and employees to address psychosocial hazards identified.
- Monitor and review:
    - The milestones in the action plan should be monitored. The effectiveness of the solutions could be evaluated by follow-up surveys.

Further information can be obtained from:

- Hans-Martin Hasselhorn, Allan Toomingas, Monica Lagerström: Occupational Health for Healthcare Workers: A Practical Guide, 1999
- CDC, NIOSH: Stress at Work
- HSE, UK: Stress - Management Standards

5.4.2 Workplace Harassment and Violence

As defined in the Tripartite Advisory on Managing Workplace Harassment, workplace harassment can occur when one party at the workplace demonstrates behaviour that causes or is likely to cause harassment, alarm or distress to another party. Such behaviour can violate a person's dignity or create an unfavourable work environment for him/her, which poses a risk to the person's safety and health.

Examples of behaviour that may be considered harassment include but are not limited to:

- Threatening, abusive, or insulting language, comments or other non-verbal gestures
- Cyber bullying
- Sexual harassment
- Stalking

Workplace violence, as defined by World Health Organisation, covers a spectrum of unacceptable behaviours. It includes incidents where staff are abused, threatened, discriminated against or assaulted in circumstances related to their work, including commuting to and from work, and which represent a threat to their safety, health, and well-being."

Workplace Harassment and Violence can occur between staff, patient to staff and public to staff. It is a recognised hazard, but the true extent may not be known as it is likely to be under reported.

Effects of Exposure

- Emotional distress;
- Psychological trauma; and
- Physical injuries.

Hazard Management System

A system should be put in place to reduce exposure of healthcare workers to violence and abuse.

The components should include:

- A clear policy known and understood to management and employees, and clearly communicated to both patients and accompanying persons
- Clearly defined protocols for dealing with at-risk situations where staff is subject to workplace harassment and/or violence
- Management commitment and employee participation in violence prevention and management as well as staff protection programmes
- Analysis of worksites:
  - A RA of the workplace should be carried out to identify the hazards and assess the severity of the risk. A review of the injury and illness records, compensation

claims and screening surveys for workplace violence would also form part or the RA;

- Safety and health training of healthcare workers should include:
  - Conflict resolution;
  - Recognising and managing workplace harassment and violence; and
  - Awareness of workplace violence;
- Record keeping:
  - All healthcare workers should be encouraged to report incidents of workplace harassment and violence and the report should also include action plans to prevent recurrence; and
- Evaluation of the programme:
  - The programme should be evaluated regularly to ensure a safe and secure workplace for all staff.

Table 32: Examples of control measures to reduce exposure (Harassment).

| **Control Approach** | **Examples of Control Measures** |
|---|---|
| Engineering Controls | • Improve the design of the working environment such as providing physical security measures. |
| Administrative Controls | • Adjust staffing schedules to ensure that staff do not work alone and to minimise patient waiting time.<br>• Control movement of the public in hospitals. |

Further information can be obtained from:

- US OSHA: Guidelines for Preventing Workplace Violence for Health Care and Social Service Workers
- CDC, NIOSH: Violence - Occupational Hazards in Hospitals
- HSE, UK: Preventing Workplace Harassment and Violence
- Protection from Harassment Act
- Tripartite Advisory on Managing Workplace Harassment

## 6. Workplace Health and Well-being

Workplace health and wellbeing has been acknowledged as an important area of focus in the wake of the COVID pandemic. Traditionally, while workplaces have developed physical health efforts in the form of health screening, provision of access to medical care and organising group physical activity sessions, further domains of mental, emotional and social have also received attention as areas for development.

In particular, workplace health and wellbeing approaches are different in healthcare organisations for two main reasons:

1. Healthcare organisations provide health interventions as part of the work done. As such, staff may themselves be a population for which the organisation can offer interventions.
2. Healthcare is a frontline and essential service, with a complex system encompassing a wide variety of occupations.

Employee's well-being is crucially important as it directly affects how employees think and feel about their job and the organisation. Employee's health and happiness is also directly related to productivity and the desire or ability to work co-operatively with co-workers and teams. As such, Human Resource (HR) played an important role in employees' health and well-being and has to be part of an organisation holistic strategy when managing the health and well-being of employees.

Health and wellbeing measures are especially important in addressing various sources of stress that healthcare workers encounter as part of their daily work.

Table 33: Sources of stress on health of healthcare workers

| | |
|---|---|
| Physical | • Needlestick/ sharps injuries<br>• Physical lifting at work<br>• Shift duty<br>• Work load<br>• Slips, trips, falls<br>• Exposure to hazardous substances/ infections/ radiation |
| Emotional | • Grief from loss of patients<br>• Moral distress<br>• Unpredictable work demands<br>• Investigation for work related mishap<br>• Staff abuse/ harassment |
| Social | • Social isolation (e.g. infection control)<br>• Limited access to social events<br>• Hierarchical work structure |

Failure to address the above stressors can lead to emotional distress, psychological trauma and physical injuries. Burnout as a syndrome, encompassing emotional exhaustion, depersonalisation and low personal accomplishment, usually accompanies long-term

stressors that go unaddressed and leads to attrition, absenteeism and reduced quality of care to patients.

### 6.1 Management System

6.1.1 Physical Health

Physical health interventions at the workplace may include the following:

- Access to health screening and appropriate follow up interventions, in line with population health measures.
- Emphasis from leadership with focus on:
  - Access to physical health resources at the workplace (e.g. staff gym/ exercise area/ regular exercise related events)
  - Information on maintaining adequate rest and sleep, taking into consideration long work hours and shift work
  - Promotion of healthy lifestyle while at work, availability of healthy meals and education on nutrition
- Updated occupational health interventions for vaccination and infection control strategies.
- Management of physical and environmental hazards.

6.1.2 Mental and Emotional Health

As part of the RA for workplace health, organisations should review the state of employees' mental and emotional health and work stressors regularly. This could be done by using wellbeing assessment tools/surveys available. A wide variety of interventions may be used to promote mental and emotional health, ranging from organisational policies and processes to ground up initiatives led by mental health champions at department level.

Examples of such interventions include:

HR Policies

- Work hours and opportunities for rest
- Work related out of hours communications
- Fair and non-discriminatory hiring practices
- Setting up of mental health awareness unit and supporting champions within each department

Mental Health Awareness

- Promote safe working environments
- Mental health awareness for staff in general to address issues such as stigma
- Training for leaders and supervisors in recognising and responding to mental health needs

Mental and Emotional Response

- Monitor mental health at work via appropriate surveys/ scales
- Peer support programme for immediate organisation level emotional first aid
- Employee assistance programme, where possible, for comprehensive counselling

Staff with Mental Illness

- Escalation process for access to specialist mental health services
- Return to Work programme for staff suffering from mental illness and fit to return to work

Support of Leadership

- Risk Management e.g. crisis at work/ bullying
- Change management during periods of stress
- Coaching and mentoring for leaders and managers within units

The following 6 steps may be used to guide the implementation of mental well-being initiatives:
*Check, Aim, Rally, Act, Tell and Refine*

Table 34: Guide to implementing mental well-being initiatives

| **Domain** | **Examples** |
|---|---|
| Check | • Assess regularly and identify needs according to<br>- Organisation<br>- Team/ Department<br>- Individual |
| Aim | • Create a mental wellbeing roadmap to set goals and track progress.<br>• Roadmap may include organisation's vision, yearly milestones and determining key indicators of success. |
| Rally | • Senior management to support and be involved in mental well-being initiatives e.g. taking lead to set up conducive workplace, host regular engagements with employees, actively participate in mental well-being initiatives, practise empathetic leadership, set aside protected time for mental wellness related activities and initiatives. |
| Act | • Choose suitable initiatives to implement e.g. peer support system, use of digital mental health tools, encourage self-care, create safe spaces for conversations, set clear expectations on after hours communication. |
| Tell | • Create a communication plan for awareness and participation e.g. identifying avenues and materials for dissemination, identify key stakeholders and change agents. |

| | |
|---|---|
| Refine | • Review initiatives regularly; conduct stock takes on implemented mental wellbeing initiatives to review their effectiveness. |

*(Adapted from Workplace Mental Wellbeing Playbook)*

6.1.3 Social Health

Social interactions at work facilitate psychological safety and allows employees to establish communities at work, with design of workplaces fostering safe interactions. Social health allows organisations and departments to build on informal ties which promote resilience during crisis. Regular engagement with staff allows management to address ground level difficulties in a timely manner and communicate the organisation's values.

Events that encompass staff's family also build strong social ties, as do events that celebrate milestones within the organisation. Education on financial literacy, coping with working from home and general matters such as parenting or caregiving considers staff as individuals, while looking outward to the community at large via voluntary work builds cohesion and a better sense of connecting with the population that the healthcare organisation serves.

**6.2 Building Resilience**

Resilience in healthcare is an important aspect of adapting to both heavy business-as-usual, as well as crisis demands. Irrespective of the theoretical model for resilience that is selected by individual organisations, the following levels of intervention should be considered:

*Primary Prevention* – core conditions to thrive at work

*Secondary Intervention* – reduce effects of stressors as they occur

*Tertiary Intervention* – support and intervene for any resulting ill health from work

(*Adapted from The Intensive Care Society Workforce Wellbeing Best Practice Framework)*

Further information can be obtained from:

- Tripartite Advisory on Mental Well-being at Workplaces by MOM, NTUC, SNEF
- A playbook on Workplace Mental Wellbeing by MOM, WSH Council, Institute for Human Resource Professionals (IHRP)
- Capacities for resilience in healthcare; a qualitative study across different healthcare contexts Hilda Bø Lyng et al BMC Health Services Research volume 22, Article number: 474 (2022)
- Employee Wellbeing Support : A Workplace Resource, Andrew Kinder, Rick Hughes and Cary L. Cooper. 2008
- The Intensive Care Society Workforce Wellbeing Best Practice Framework

## 7 Emergency Preparedness and Response

Planning and preparing for emergencies is an essential part of hazard prevention and control. It is the responsibility of the management to establish and maintain plans and procedures to identify the potential situations and responses to incidents and emergency situations. These plans and procedures should also be frequently reviewed and updated.

The emergency response plan should form part of the safety and health management system. It should include procedures for all possible emergencies that the healthcare facility may encounter and should be placed under the charge of an emergency response team that is appointed and supported by the management.

### 7.1 Emergency Response Plan

An effective emergency response plan should include the following characteristics:

Corporate Policy

This policy should emphasise the importance of hazard prevention and its mitigation, emergency response planning and affirms management support for the emergency response initiative.

Emergency Planning and Response Committee

An emergency planning and response committee should be set up to create, implement and execute contingency plans in times of emergencies and to prevent accidents and loss of life and property. The tasks of the key appointment holders should be identified and described.

Incident Command System

A command and control system to coordinate actions during an emergency should be established. It should detail the chains of command or responsibility, roles and responsibilities of designated employees, the communication network and “alerting” procedures, for both during and after office hours, to be used during an emergency. Communication with external emergency agencies (e.g. Singapore Civil Defence Force (SCDF) and NEA, regulatory agencies (e.g. MOH and MOM), and other stakeholders (such as members of public, customers, neighbouring premises/companies) should be established.

Emergency Evacuation Procedures

The evacuation procedures for inpatients, outpatients, employees and on-site contractors (including tenants and visitors) should be elaborated. It should detail the various evacuation routes and assembly areas for partial or full evacuation.

Protection of Vital Records and Equipment

Designated employees should be trained in emergency shut-down or lock-out procedures for critical equipment prior to evacuation. Procedures for protection of records vital to the facility should be established.

Emergency Response Equipment Maintenance and Testing

To ensure that all emergency equipment is in proper working order, it is critical to have qualified personnel to carry out regular servicing of the emergency equipment to ensure its readiness of usage during emergency.

Training and Medically Fit Response Team

Training for all levels of employees within the organisation should include evacuation procedures and routes, shut-down procedures, and usage of emergency equipment (e.g. self-contained breathing apparatus). It is recommended to assess response team member fitness before appointment and periodically to ensure he/she is medically fit.

Regular Review and Updating

The emergency response plan should be regularly reviewed and updated. Tabletop exercise with practice drills should be carried out according to a pre-determined schedule. Results and findings from practice drills should be recorded and reviewed by the management with corrective action plans.

**7.2 Fire**

With reference to SCDF requirement, each healthcare facility should have an appointed person such as Fire Safety Manager to ensure and enhance the fire safety standard within the facility, as required by the SCDF.

The healthcare facility should have a written fire emergency plan, in accordance with guidelines issued by Singapore Civil Defence Force (SCDF), including an evacuation plan that is accessible and available to employees. The plan should include the following.

- Employees must be trained to recognise fire alarms;
- Responding and reporting on fire emergencies (internal/external responses);
- Process of reporting fires and smoke;
- Identity of person to contact, including designation and contact number;
- Emergency escape procedures and escape routes;
- Procedures for employees who must remain to operate critical equipment before they evacuate;
- Procedures that account for all employees after evacuation;
- Rescue and medical duties for employees performing the duties;
- Fire protection equipment and systems available to control ignition sources; and
- Procedures and schedules for equipment maintenance.

All employees must be aware of the workplace emergency and fire evacuation plan. Fire drills should be conducted periodically and documented. The employees should be aware of their role in the event of any emergency situation and fire evacuation.

### 7.3 Chemical Spill or Leak

Each healthcare facility should have an appointed chemical spill response team/individual in charge. The team/individual in charge should prepare a Chemical Spill Response Plan which should include the appropriate specific procedures and response equipment for dealing with a chemical spill. It is the responsibility of each healthcare employee using chemicals and chemical products to be familiar with this plan.

The plan should include:

- Process of reporting chemical spill;
- Identity and contact number of appointed chemical emergency response team leader and its members;
- SDS of the chemicals used in the premises;
- Procedures for initial containment of the spill and possible fire if the chemical is flammable;
- Procedures for the evacuation of non-essential personnel;
- Procedures for those employees who must remain to operate critical equipment before they evacuate;
- Provision of chemical spill response kit and PPE for chemical emergency response team;
- Procedures for administering first aid treatment to personnel exposed to chemical; and
- Procedures for packaging and disposal of contaminated chemicals and spill response equipment.

All employees who handle chemicals must be aware of the chemical spill response plan. Practice drills should be conducted periodically and documented. The employees working in areas where hazardous chemicals are used or handled (e.g. laboratories, CSSU, TSSU) should be aware of their role in the event of an emergency situation.

Use of suitable materials, for example sand, earth or sodium bicarbonate to contain/absorb the spillage should be considered. Paper towels and sponges may be used as absorbent type clean-up aids but this should be done cautiously. Paper used to clean up oxidisers can later ignite and appropriate gloves should be worn when cleaning toxic materials with towels. Sponges should be chemical resistant. Contaminated residues should be collected in a suitable, clearly labelled container prior to disposal as “contaminated” or “special waste”.

Commercial spill kits are equipped with instructions, absorbents, neutralisers and protective equipment. These clean-up supplies should be consistent with the hazards and quantities of substances used. These kits should be located strategically around the department area.

All personnel working with hazardous chemical including “response teams” must be trained in the appropriate spillage procedures. The training should also include familiarisation with areas covered by the teams. The training should include the use of any special equipment and PPE. The training must be recorded and personnel should be retrained at appropriate intervals.

### 7.4 Outbreak, Prevention and Control

In healthcare settings, proper observation by all staff of standard and transmission-based precautions are required for outbreak prevention and control.

#### 7.4.1 Standard Precautions

In the care of all patients, standard precautions include:

- Hand hygiene
- Cough etiquette
- Use of personal protective equipment based on risk assessment
- Needle stick or sharp injury prevention
- Blood or body fluid exposure prevention
- Safe injection practices
- Environmental hygiene
- Linen and waste management

#### 7.4.2 Transmission-based Precautions

When caring for patients who are (or are suspected to be) infected by an agent with known mode of transmission, transmission-based precautions are needed to prevent spread. The three forms are contact precautions, droplet precautions, and airborne precautions.

1. *Contact precautions* include the use of gloves and gowns. In acute settings such patients should be isolated or cohorted in keeping with national guidelines.

2. *Droplet precautions* include the use of masks and eye cover (either visors or goggles).

3. *Airborne precautions* require the use of N95 masks and the isolation of patients in negative pressure rooms.

#### 7.4.3 Infectious Disease Surveillance

In acute healthcare facilities, surveillance is necessary to systematically monitor the trends in healthcare-associated infections, multi-drug resistant organisms as well as Infection Prevention and Control (IPC) activities.

In Long-Term Care Facilities (LTCF), targeted IPC outcomes should be monitored by using surveillance for healthcare-associated infections in high-risk populations. Results must be

analysed and reviewed in a timely manner. A plan for improvement, including organizational accountability, must be developed by the targeted area in conjunction with IPC staff based on the results of surveillance.

7.4.4 Healthcare-Associated Outbreak Response in Acute Healthcare Facilities

1. *Disease notifications:* As stipulated under the Infectious Diseases Act, medical practitioners and laboratories must notify the infectious diseases of public health importance to MOH within the timelines stipulated.

2. *Outbreak management:* The MOH healthcare epidemiology team may be contacted to assist the affected healthcare facilities in the investigation of healthcare associated outbreaks.

3. *Preparedness and response:* As stated in Chapter 10 of the National IPC Standards for Acute Healthcare Facilities, Revised 2022, preparedness plans should be in place for a hospital to respond promptly to prevent spread of the infectious disease of concern.

7.4.5 Healthcare-Associated Outbreak Response in LTCF

1. *Preparedness Planning:* IPC personnel should play a key role in the LTCF's IPC preparedness planning and risk assessment. The LTCF should be prepared in the detection, management and response to outbreaks.

2. *Recommendations:* As stated in the National Infection Prevention and Control Guidelines for Long-Term Care Facilities, Revised 2021,
    - Each LTCF should have a written policy describing how the guidelines are to be met.
    - Healthcare settings must evaluate their IPC needs and implement an IPC programme suited to those needs.
    - Periodic review of the IPC programme must be carried out to evaluate the organization's needs and determine the elements required to meet the goals of the IPC programme in the LTCF.
    - Support from leadership and the IPC committee should be sought for the implementation and execution of the IPC programme by specified personnel.
    - Each LTCF should have a multi-disciplinary IPC committee whose responsibilities include annual goal-setting, programme evaluation and ensuring that the IPC programme meets current legislated standards and requirements, as well as the needs of the facility.
    - LTCFs should monitor targeted IPC processes with regular audits of practices.

7.4.6 Additional Measures

To prevent the transmission of infections from healthcare workers to patients and to ensure personal protection of employees, vaccination records of all employees will need to be maintained. Employees will be screened for immunity to varicella, measles and hepatitis B. Immunisation for varicella and boosters for mumps, measles, rubella (MMR), tetanus, diphtheria, pertussis (Tdap), and hepatitis B should be given if required. Furthermore, all employee immunisation programmes should include annual influenza vaccination.

### 7.5 First Aid

Accidents can occur to anyone and in the healthcare industry. Slips, trips and falls, needle stick injuries, contact with hazardous chemicals and burns can occur. The appropriate first aid given to the injured person is important in saving lives and preventing further injury and pain. Provisions should be made to enable first aid delivery to any person who is injured or becomes ill while at work and emergency procedures developed and practised regularly. Those giving first aid should be aware of the associated hazards as they may come into contact with bloodborne pathogens such as hepatitis and human immunodeficiency virus (HIV) and other potentially infectious materials. They should practise standard precautions (such as good hand hygiene) and be aware to protect themselves when administering assistance or first aid to the injured persons. The appropriate PPE such as impervious gloves, gowns and face masks can be used if there is a risk of exposure to the bloodborne pathogens and other infectious materials. In addition, they should also be aware of safe clean-up procedures of body fluids and soiled surfaces.

Some workplaces may use hazardous or toxic substances. If there is exposure to these substances, suitable facilities for emergency treatment such as emergency showers for quick drenching and eye wash for flushing of eyes should be available. These facilities for emergency use should be readily accessible and be properly maintained.

## 8 Facilities Management

### 8.1 Safety in Construction and Renovation

General

- Prior to commencement of works, RA should be carried out for all construction and renovation works.
- All staff should be briefed on the intended construction works to be carried out, emergency plans and safety procedures to be followed.
- Site-specific protocols related to construction safety and health should be established for specialised areas within the facility.

Material Handling and Storage

- No storage of Petroleum and Flammable Materials (P&FM) in the construction/renovation site unless approval is sought from the Building Fire Safety Manager.
- Storage of the construction materials in the construction/renovation site should not obstruct any emergency exits, fire escape routes or fire-fighting equipment.
- Proper housekeeping should be maintained within the construction site and its surroundings. All materials should be properly stored and all waste materials properly disposed.
- SDS for construction materials should be made easily accessible to all workers and the hospital's employees affected by the construction and renovation works.

Welding and Cutting

- Compressed gas cylinders should be properly secured and kept in an upright position at all times.
- Fire extinguishers and fire blanket should be adequately provided at work areas where welding and cutting works are being carried out.
- Welder(s)/cutter(s) shall be competent for the job (e.g trained welders with welding certificates).
- Welder/cutter shall be equipped with proper PPE for the work.
- Welding and cutting tools and equipment shall be inspected and in good working condition before use.
- Fire watch shall be arranged for pre, during and post welding and cutting work.
- A Hot Work Permit System should be implemented and hot work permits should be completed and posted at the work location.
- To avoid accidental activation, the fire alarm system within the building should be properly isolated before hot work is allowed to be carried out in the construction/renovation site. When the fire alarm system is being isolated, a fire monitoring procedure must be set up for notification to the Fire Command Centre (FCC) if a fire outbreak at the isolated zone. Immediate reinstate of the fire alarm system must be done once the hot work is completed.

Fire Safety

- An adequate number of fire extinguishers should be provided. They should be properly tagged and inspected.
- Firefighting/protection equipment (fire extinguishers, hose reels, call points etc) are to be made accessible at all times.
- Training of workers on the use of firefighting equipment should be conducted.
- Temporary construction partitions should be smoke tight and made of non-combustible materials.
- Clear indication of evacuation directional route and posting of evacuation map.

Electrical Safety

- Temporary lightings should be in place for access areas and locations where works are being carried out.
- Junction boxes and panels should be properly covered.

Miscellaneous

- Ladders and scaffolds should be of sound construction.
- All floor openings should be properly covered. Security measures should be put in place to prevent unauthorised entry into the construction site.
- Proper identification tags should be provided for all construction workers.
- Notification policy for deactivating life safety devices (smoke detectors, fire alarm systems etc.) should be periodically reviewed.
- Contingency plans should be developed for emergency responses to power failures, water supply disruptions and fires.
- Appropriate noise control plan and dust control plan should be developed.

Further information can be obtained from:

- WSH (Construction) Regulations 2007

**8.2 Indoor Air Quality and Ventilation**

Indoor Air Quality (IAQ) refers to the quality of indoor air as it relates to pollutants that may be airborne in the building. The pollutants may be brought into the building from outside or may come from the building itself.

Building pollutants may include but are not limited to:

- pollen
- dust
- fungal spores
- vehicle or building exhaust returning into the building by re-entrainment
- soil gas (found in the soil as a result of decaying matter)
- leakage or spills
- radon
- leakage from underground storage tanks
- standing water on roofs and in ducts that encourages microbial and fungal growth
- ozone from copy machines

- volatile organic compounds (VOC) from various solvents
- tobacco smoke
- cooking
- cooling tower that encourages microbial growth
- building vermin
- wet and damp areas in ductwork where ideal conditions cause pathogens to grow
- off- gassing of various building materials

Good IAQ improves productivity at the workplace. On the other hand, poor IAQ could lead to losses in productivity as a result of comfort problems, ill health and sickness-absenteeism. All workplaces within your healthcare facility should be ventilated by natural or mechanical means e.g. Air-Conditioning Mechanical Ventilation (ACMV) to provide a constant and sufficient supply of fresh air for all employees.

Employees should also be protected from inhalation of any contaminants in the workplace. All dust, fumes, steam or other airborne contaminants which arise as a result of any process or in the course of work should be removed at the source. This can be achieved through elimination or isolation of people from the contamination and implementation of control measures such as dilution ventilation, filtration, mechanical extraction systems or a combination of these.

Indoor Air Quality and Ventilation Management Programme

The management, together with the facilities management team, should implement a management plan to ensure that good IAQ is achieved in all workplaces within your healthcare facility. The programme should include but should not be limited to the following components. Individual components can be delegated to responsible persons.

- *Written Policy on Indoor Air Quality and Ventilation*
  The policy statement should state explicitly the responsibility and commitment of management to achieve good IAQ for all occupants in the healthcare facility.

- *Documentation of Ventilation Systems in Place*
  Documents showing the layout and location of the ACMV system and other forms of extraction systems (e.g. downdraft tables and biological hoods) of your facility should be kept. This documentation should aid the facilities management team to locate major building system equipment and the areas they serve. Where changes are made to any system, the main design plan should be updated.

- *Regular Inspections and Air Monitoring*
  Regular walk-through inspections of the premises and the ventilation systems including ACMV, should be conducted by a competent person. A checklist listing the major systems and equipment needed to be inspected can be used during inspection. Checks on ductwork, humidifiers and other ACMV and building system components should be conducted to detect any microbial growth or contamination. Feedback from occupants on the conditions in the building and the operation of the ACMV system can be obtained during inspection to identify possible irregularities. Indoor air monitoring and any

environmental or biological sampling should be conducted by the competent persons if deemed necessary for the investigation so that adjustments or alterations can be made.

- *Preventive Maintenance Regime*
  There should be established, a written maintenance plan and scheduling of maintenance for the various components of the air-conditioning and exhaust systems. The maintenance plan should include reasonable and appropriate measures to avoid degradation of the air quality during renovation and construction works.

- *Training and Information*
  *The employees who are involved in building system operation and maintenance must be provided with training on:*
    - Types of ventilation systems that are used and how they operate;
    - Use of PPE; and
    - Control measures to ensure proper ventilation during building cleaning, maintenance and when handling chemicals and other harmful agents.

- *Records*
  *The following records should be maintained for reference and audit checks:*
    - IAQ and ventilation systems inspection records;
    - Incidents investigation reports;
    - Employee complaints detailing signs or symptoms that may be caused by building related illness; and
    - Action plans to rectify any problem areas identified through investigation of complaint or incident.

Further information can be obtained from:

- MOM: Guidelines on Design, Operation and Maintenance of Local Exhaust Ventilation Systems.
- NEA: Guidelines for Good Indoor Air Quality in Office Premises.
- Singapore Standard SS554: 2016 Code of Practice for Indoor air quality for air-conditioned buildings

**8.3 Safe Means of Access and Egress**

- Safe means of access should be provided to and from:
    - Workplace; and
    - All work-related areas at a workplace.
- All means of access and egress should be free from obstructions.
- Handrails should be provided at access and egress areas where appropriate to prevent slipping.
- Exit signs should be posted and properly lit.
- All means of access or egress should be properly maintained.

Further information can be obtained from:

- WSH (Construction) Regulations 2007

**8.4 Maintenance of Facilities**

Control of Hazardous Energy: Lockout/Tagout

Maintenance and repair work on hazardous machinery or electrical installations have led to serious or fatal accidents in the past when such machinery or installations were not properly deactivated or de-energised. A few accidents had also occurred when such machinery or installation were inadvertently activated when workers were still carrying out the servicing or repair.

Employers of the servicing/repair workers should establish and implement lock-out procedures for the inspection, cleaning, repair or maintenance of any machinery, equipment or electrical installation that, if inadvertently activated or energised, could cause bodily injury. Such lock-out arrangements are often supplemented with a tag-out system to ensure a clear warning system is in place against inadvertent activation while work is still being carried out on the machinery or installation.

Every person carrying out the inspection, cleaning, repair or maintenance of such machinery, equipment or electrical installation must be fully instructed on the Lock-Out and Tag-Out (LOTO) procedures for that work before commencing the work.

It is important that any cleaning, servicing, maintenance or repair of hazardous machinery and electrical installation be carried out by competent personnel who are well instructed and familiar with the proper procedures, including the necessary LOTO procedures. Hence, these works should always be carried out by agents or suppliers of the machinery or electrical installation.

Further information can be obtained from:

- Singapore Standard (SS) 571: 2011 Code of Practice for Energy lockout and tagout

Electrical Safety

Electricity is a common source of energy widely used to power and run many types of equipment and appliances. When work is carried out with an electric powered tool or on an electrical circuit, the worker is exposed to the risks of electrical hazards. An accident involving electricity can cause a range of injuries such as electric shock, electrical burns, loss of muscle control and thermal burns.

In an electric shock, voltage as low as 50 volts applied between two parts of the human body can cause a current to flow that can block natural electrical signals between the brain and the muscles. This may result in stopping the heart from beating properly, preventing the person from breathing and causing muscle spasms. At high voltage or when the current flows through

the body for more than a few fractions of a second, the current can result in deep electrical burns that are permanently disabling. People who receive an electric shock often get painful muscle spasms that can be strong enough to break bones or dislocate joints. People can also receive thermal burns when they get too near hot surfaces from overloaded, faulty or shorted electrical equipment or if they are involved in an electrical explosion.

Electrical appliances and equipment are generally safe for use if they are designed and manufactured to acceptable electrical standards and codes, and that have been maintained in such a condition. Most electrical appliances are built with safeguards to prevent any overcurrent or earth leakage from reaching a dangerous level to injure a person. It is important that such safeguards are maintained to be in good working condition to provide the protection.

Before operating any electrical equipment or appliances, a visual inspection should be carried out to detect any defects or deterioration to the equipment such as inadequate wiring, exposed electrical parts or wires, bad insulation, overloading of the circuit from plugging too many appliances into the same source (main socket), wetness and spilled chemicals. Any necessary repair, maintenance or servicing of the equipment work should always be carried out by competent persons such as the agents or suppliers of the equipment.

Another common source of electrical hazards is the electrical installation. Electrical installations must be installed in accordance with Singapore Standard SS 638:2018 Code of Practice for Electrical installations. Installations, repairs, maintenance and inspections should always be carried out by the electrical workers licensed by the Energy Market Authority.

Pressure Vessel Safety

Autoclaves, air receivers and steam boilers are pressure vessels which can potentially explode and result in serious or fatal accidents and cause major property damage if they fail while in operation. These pressure vessels are used in hospitals and other healthcare facilities.

Owners of these pressure vessels should ensure the integrity of these pressure vessels to prevent any mishap by using pressure vessels that are designed and fabricated in accordance to internationally acceptable codes and standards such as the American Society of Mechanical Engineer's (ASME) Code and the British Standards. These pressure vessels must be examined and tested by Authorised Examiners before they are first being put into use.

Steam receivers and air receivers are required to have mandatory periodic inspections by Authorised Examiner once every 24 months while the inspection interval for steam boilers is once every 12 months.

Organisations are to refer to the MOM's website for the list of Authorised Examiners, as well as related guidance materials such as the Guidelines for the Registration of Pressure Vessel in Workplaces by Authorised Examiner and the Guide to Local Fabricators of Pressure Vessels.

All operators of the pressure vessels must be trained on its safe operating procedures and be provided with all the necessary protective equipment. Operators of steam boilers must be trained and competent before they can operate them.

Besides the statutory inspections, pressure vessels should also be regularly serviced and maintained to ensure the equipment is functioning properly. Owners should always consult an Authorised Examiner and engage a competent boiler contractor for any repair carried out on a pressure vessel.

Confined Spaces

A confined space is any space that is large enough for an employee to enter and perform assigned work; contains or has the potential to contain hazardous atmospheric hazards capable of causing death or serious physical injury; has restricted means for entry or exit and is not designed for continuous employee occupancy.

Employers requiring their staff to work in confined spaces are required to implement a programme for controlling and where appropriate, protecting employees from confined space hazards and for regulating employees' entry into confined spaces.

SWPs and protective equipment shall be ensured and provided for employees:

- Implement measures necessary to prevent unauthorised entry;
- Identify and evaluate the hazards before employee enters the confined space;
- Policies and procedures to specify acceptable entry conditions, isolating the confined space, purging, inerting, flushing, or ventilating the confined space, providing pedestrian and vehicular barriers, and verifying that conditions in the confined space are acceptable;
- Provide testing and monitoring equipment;
- Provide ventilation equipment;
- Provide communication equipment;
- Provide PPE where necessary;
- Provide lighting equipment needed to enable to employees to see well enough to do their work and to exit the space quickly in an emergency;
- Provide barriers and shields;
- Provide equipment for safe ingress and egress by authorised entrants; and
- Provide rescue equipment and any other equipment necessary for safe entry and rescue.

The employer should provide training to those employees working in such areas so that they can perform the work safely. The employer should certify that the training has been accomplished before assigning the employee to work in this area. The duties of all authorised entrants, attendants, and entry supervisor should be clearly defined and documented.

Further information can be obtained from:

- Singapore Standard SS 568: 2011 Code of Practice for Confined spaces
- WSH Council Technical Advisory on Working Safely in Confined Spaces
- WSH (Confined Spaces) Regulations 2009

### 8.5 Hazardous Waste Management

Healthcare facilities generate diverse wastes that require proper disposal. These wastes are often hazardous, and must therefore be packaged, transferred and disposed off properly to protect the person handling it and the environment at large.

Types of Hazardous Waste Generated

Wastes from healthcare facilities include infectious waste, pathological waste, contaminated sharps, routine clinical waste, cytotoxic waste, radioactive waste, pharmaceutical waste, chemical waste and general waste.

Infectious waste is defined as waste that is capable of causing an infectious disease. Infectious waste includes sharps, microbiological cultures, pathological organs and other waste from patients with Biosafety Level III (e.g. Hepatitis B) and IV (e.g. Lassa fever) infections. Waste that is heavily soiled with the patient's blood or body fluid should also be treated as potentially infectious.

Infectious waste, pathological waste, contaminated sharps and other contaminated waste from treatment areas are considered as biohazardous wastes which need special handling and disposal by licensed biohazardous waste contractors. Infectious waste, in addition, may need pre-treatment before it is disposed of as biohazardous waste. Beside biohazardous waste, expired cytotoxic drugs and waste materials which are contaminated with cytotoxic drugs during the preparation and administration of cytotoxic therapy are also required to be properly handled and incinerated by approved biohazardous waste incinerators.

Pharmaceutical wastes are also commonly found in healthcare facilities. Depending on the nature of the pharmaceutical waste, they could be either disposed off through special waste incinerators or as general waste.

Chemical wastes include discarded solid, liquid and gaseous chemicals from diagnostic and experimental work, and from cleaning, housekeeping disinfecting and engineering services such as used lubricating oil, spent photographic developing solutions and spent solvents. These wastes should be segregated as biohazardous and non-hazardous waste for special disposal by licensed toxic waste contractors.

General wastes generated in healthcare facilities may include office waste, food waste, packing materials, wastewater from laundries and floor washing and other substances that do not pose any significant contamination risk in handling. Such wastes could be disposed off as general household waste by general waste contractors at public waste disposal facilities if they are not contaminated with biohazardous or toxic waste.

Hazardous Waste Management Programme

The management of all healthcare facilities should develop a hazardous waste management programme suitable for the size of the facility and types of wastes generated. The hazardous waste management programme should form part of the safety and health management system. The management should also appoint person/s within the facility with the responsibility for maintenance and management of waste transfer and disposal documentation, such as the generation, collection, treatment and safe disposal of hazardous waste.

The hazardous waste management programme should include the following elements.

*Identification of Hazardous Waste*

This includes designation of the waste that should be managed as biohazardous and segregation of biohazardous waste from non-biohazardous waste. Proper labelling on the waste container is critical to identify the type of hazardous waste according to NEA's hazardous waste classification.

*Safe Work Procedures*

Written procedures on treatment of all types of wastes generated by the healthcare facility should be established and documented. A transport and disposal flowchart from the generation site to the disposal site can be drawn up to provide clarity on the sources of wastes. The responsibilities of personnel should be described in these procedures.

*Packaging of Waste*

Colour-coded disposal bags must be used to segregate wastes that need special handling and disposal.

Table 35: Types of waste and segregation

| **Type of waste** | **Sharps or breakable objects present?** | **Puncture resistant container required?** | **Colour code** | **Examples** |
|---|---|---|---|---|
| Biohazardous only | No | No | Yellow | • Gauzes soiled with bodily fluids |
| | Yes | Yes | Yellow | • Used syringes and tubings contaminated with bodily fluids<br>• Partially filled glass vials of hazardous drugs |
| Cytotoxics | No | No | Purple | • Expired cytotoxic drugs<br>• Disposable gloves, bench wipes and gowns used during |

| | | | | |
|---|---|---|---|---|
| | | | | chemotherapeutic drugs preparation |
| Biohazardous contaminated with cytotoxics | Yes | Yes | Purple | • Used syringes and tubings for administering chemotherapeutic drugs<br>• Glass vials with cytotoxic drug residue |
| Radioactive | No | No | Red | • Disposable gloves and bench wipes used in the preparation of radioactive materials |
| Biohazardous and contaminated with radioactive materials | Yes | Yes | Red followed by yellow (after the radioactive material has decayed to the safe level) | • Used syringes for administering radioactive isotopes to patients |
| General waste | Yes/No | If practicable | Black | • Empty antibiotics and vaccines vials<br>• General pharmaceutics (vitamin tablets, creams and ointments) |

*Storage*

All hazardous wastes stored should be quantified and tracked. A register of all the wastes that are being generated and stored should be kept. The register should include:

- type and quantity;
- source of waste e.g. department or unit;
- date ready for disposal; and
- appointed licensed collector.

All containers used for storing hazardous wastes should be clearly labelled with the type of wastes, and where possible, the associated safety and health hazards and recommended PPE during handling.

*Disposal*

The management should identify off-site hazardous waste collectors licensed by NEA to collect and dispose off the various types of hazardous wastes. All waste generated by healthcare institutions must be dispose off in accordance to legal requirements. Waste must be segregated into hazardous and non-hazardous waste so that it can be safely dispose off by

the respective licensed waste contractors. The management should develop a licensed hazardous waste collector assessment programme to verify the capability and competency of potential off-site hazardous waste contractors in handling their wastes.

*Contingency Measures for Emergency Situations*

The management should establish emergency response plans and procedures to deal with on-site incidents involving hazardous wastes and provide adequate hazardous material response equipment.

*Staff Training*

All personnel involved in the generation, packaging, handling, storage and disposal of hazardous wastes,
especially infectious waste should be properly trained to ensure that they are equipped with the appropriate knowledge (potential health hazards and precautions to take, safe handling techniques and disposal procedure).

Further information can be obtained from:

- Singapore Standard SS 603: 2021 Code of Practice for Hazardous Waste Management
- Environmental Public Health (Toxic Industrial Waste) Regulations

**8.6 Lighting**

The level of lighting provided and its distribution within workplaces have a major impact on how quickly, safely and comfortably employees are able to carry out their tasks. Adequate and uniform lighting help to reduce visual fatigue and provide for the health and safety of all employees in the workplace. The management should ensure that suitable lighting, depending on the type of task being carried out is provided for all work areas within the healthcare facility.

Measurement of lighting level should be carried out as part of the facilities maintenance programme to ensure adequate lighting is provided and a smooth transition between work areas with different lighting requirements.

Lighting values and recommendations can follow those set out in

- Singapore Standard SS 531: 2006 (2019) Code of Practice for lighting of work places Part 1: Indoor; and
- Singapore Standard SS 531: 2006 (2019) Code of Practice for lighting of work places Part 2: Outdoor.

All exits, both normal and emergency, should be lit and provided with additional emergency lighting where necessary.

Outdoor areas such as walkways should be satisfactorily lit for work and access during hours of darkness to provide safety and security to both visitors and employees.

### 8.7 Signs, Colour Coding and Marking

Suitable safety signs are to be provided whenever there is a risk that has not been avoided or controlled by other means e.g. by engineering controls and safe systems of work. The areas that require putting up of safety signs can include those where chemical, noise, machinery, radiation, respiratory, flammable, radioactive, explosive and biological hazards exist. Safety signs of appropriate size (25 cm x 25 cm) should be displayed in such positions which can be clearly seen by persons working or entering into an area.

Safety signs which encapsulate appropriate colour and various geometric shapes with a graphical symbol symbolises a general safety message. It is therefore, important for healthcare workers, nurses, doctors, therapist, cleaners, etc, to be conversant in identifying the safety signs and know what they need to do when they see a safety sign.

Safety signs can be classified into the following five main categories according to its functions.

- Prohibition signs;
- Mandatory action signs;
- Warning signs;
- Fire safety signs; and
- Means of escape and emergency equipment signs (safe condition signs).

The following are examples of common safety signs used in workplaces.

Prohibition Signs

| | | |
|---|---|---|
|  **P002** **No smoking** |  **P003** **No open flame; Fire open ignition source and smoking prohibited** |  **P009** **Do not operate** |

Mandatory Action Signs

**M002**
**Wear eye protection**

**M004**
**Wear hearing protection**

**M006**
**Wear hand protection**

**M007**
**Wear foot protection**

Warning Signs

**W009**
**Warning: Biological hazard**

**W012**
**Warning: Flammable material**

**W013**
**Warning: Toxic hazard**

**W015**
**Warning: Electrical hazard**

Fire Safety Signs

**F001**
**Fire extinguisher**

**F002**
**Fire hose reel**

**F006**
**Fire emergency telephone**

Safe Condition Signs

**E002**
**Emergency exit (right hand)**

**E003**
**First aid**

**E004**
**Emergency telephone**

Further information can be obtained from:

- Singapore Standard SS 508: 2013 Graphical symbols – Safety colours and safety signs Part 3: Design principles for graphical symbols for use in safety signs

- British Standard BS 5499: 2002 Graphical symbols and signs – Safety signs, including fire safety signs - Part 5: Signs with specific safety meanings

## 9 Acknowledgements

The Workplace Safety and Health Council would like to acknowledge contributions from the Workgroup for the Revision of the WSH Guidelines for Healthcare (WG) who are instrumental in the revision and drafting of this guideline. The Workgroup comprises of

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The Workplace Safety and Health Council would also like to thank the below infectious diseases experts from National Centre for Infectious Diseases (NCID) for their inputs in "Outbreak Prevention and Control"

1. Associate Professor Ooi Peng Lim, Senior Consultant, NCID
2. Dr Gao Qi, Senior Epidemiologist, NCID
3. Dr Tan Seow Yen, Infectious Disease Consultant Physician, NCID

The Workplace Safety and Health Council would also like to acknowledge contributions from the following agencies for their inputs

- Singapore Health Services (SingHealth)
- National Healthcare Group (NHG)
- National University Health Services (NUHS)

- Raffles Medical Group
- Mount Alvernia Hospital
- IHH Healthcare Singapore
- Agency for Integrated Care
- Ministry of Health (MOH)
- Ministry of Manpower (MOM)