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# Handbook of Occupational Hazards and Controls for Medical and Surgical Staff

**Government  
of Alberta** ■



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This document has been developed by the Government of Alberta and derived as a profession-specific summary of information contained in the five volumes of Best Practices in Occupational Health and Safety in the Health Care Industry. Full text of these documents can be found at <http://www.employment.alberta.ca/SFW/6311.html>

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# Occupational Health and Safety Hazards and Controls for Medical and Surgical Staff

## Introduction

As part of the Alberta Healthcare Initiative, a series of Best Practice documents were produced by Alberta Employment and Immigration – Workplace Health and Safety to better acquaint healthcare workers (HCW) with workplace hazards and appropriate control measures. Five documents have been produced; each developed with the input of a multidisciplinary stakeholder group. The documents are available on the Alberta Employment and Immigration website <http://www.employment.alberta.ca/SFW/6311.html> as follows:

*Overview of Best Practices in Occupational Health and Safety in the Healthcare Industry Vol. 1*

[http://www.employment.alberta.ca/documents/WHS/WHS-PUB\\_bp009.pdf](http://www.employment.alberta.ca/documents/WHS/WHS-PUB_bp009.pdf)

*Best Practices for the Assessments and Control of Biological Hazards Vol. 2*

[http://www.employment.alberta.ca/documents/WHS/WHS-PUB\\_bp010.pdf](http://www.employment.alberta.ca/documents/WHS/WHS-PUB_bp010.pdf)

*Best Practices for the Assessments and Control of Chemical Hazards, Vol. 3*

[http://www.employment.alberta.ca/documents/WHS/WHS-PUB\\_bp011.pdf](http://www.employment.alberta.ca/documents/WHS/WHS-PUB_bp011.pdf)

*Best Practices for the Assessments and Control of Physical Hazards, Vol. 4*

*Best Practices for the Assessments and Control of Psychological Hazards, Vol. 5*

In an effort to focus the hazard assessment and control information for specific healthcare professions, a series of short summaries of relevant information have been produced using excerpts from the five best practice documents. Readers are directed to the original documents for more details and more comprehensive information. *Please note that hyperlinks are provided to reference documents for the convenience of the reader. These links are functional at the time of first availability of this document but, due to the changing nature of web information, may not be functional at a later date. The Government of Alberta does not assume responsibility for updating hyperlinks.*

This document focuses on hazards and controls for workers on Medical and Surgical Units (including Medical Oncology) and Emergency Rooms. Much of this information may also be useful for any workers providing direct patient care including those in long term or continuing care, homecare, outpatient or community clinics, and staff offering specialized medical services such as dialysis.

## Hazard Assessment Process

Medical and surgical caregivers may be exposed to a variety of workplace hazards in the course of performing their functions. The type and degree of exposure is dependent upon a variety of individual factors including patient-related factors as well as environmental issues. A key component of a health and safety program is to identify and assess hazards and determine appropriate controls. A systematic approach to hazard assessment includes the following steps:

1. List all work-related tasks and activities.
2. Identify potential biological, chemical, physical and psychological hazards associated with each task.
3. Assess the risk of the hazard by considering the severity of consequences of exposure, the probability that the exposure will occur and the frequency the task is done.
4. Identify the controls that will eliminate or reduce the risk. The hierarchy of controls should be followed. This means that engineering controls are the most effective, followed by administrative controls (such as training and rules), and followed by personal protective equipment (PPE).
5. Implement the controls for each hazard.
6. Communicate the hazard assessments and required controls to all workers who perform the tasks.
7. Evaluate the controls periodically to ensure they are effective.

## Potential Hazards and Recommended Controls

The following charts summarize potential hazards for medical and surgical care givers and recommended controls to reduce the risk of exposure to the hazards.

## Biological Hazards and Controls

In this section the most commonly encountered biological hazards for medical and surgical caregivers and methods to control them are presented. Employers should carefully evaluate the potential for exposure to biohazardous materials in all tasks and ensure that they have an effective hazard control plan in place. This information will be useful for inclusion into hazard assessments. Please note, this is not designed to be an exhaustive treatment of the subject, but is rather an overview summarizing the most frequently encountered biological hazards by medical and surgical caregivers.

**Note:**

The following chart provides basic information about control strategies for commonly occurring biological hazards. Administrative controls are based on the risk assessment. Worker education and good communication processes are important administrative controls. Any PPE selected must be based upon the risk assessment of the task and the environment in which it is used. All legislation related to the selection and use of controls must be followed.

| Potential Biological Hazards  | Summary of Major Control Strategies   |  |  |
|---|---|--|--|
|   | Engineering   | Administrative   | PPE  |
| <b>Exposure to bloodborne pathogens through needle stick injuries, contaminated items and surfaces, exposure to mucous membranes</b>  | Engineered needle stick prevention devices. Availability of sharps containers for disposal. Vaccines. | Compliance with all infection prevention and control practices. Disinfection procedures. Spill response procedures. Immunization program. Worker education. Reduction of the number of staff participating in operations. Hands-free, no-pass or no-touch techniques for instrument passing. | Gloves, protective clothing, eye and face protection   |
| <b>Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents</b> | Early detection of infection status. Isolation. Vaccines.   | Compliance with all infection prevention and control practices. Immunization program. Worker education. Reduction of the number of staff participating in operations.  | PPE based on the risk assessment may include gloves, eye, face and respiratory protection, plastic sleeves, double gloves and other protective clothing. |

|   |   |  |   |
|---|---|--|---|
| <b>Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment</b> | Early detection of infection status. Isolation. Vaccines  | Good housekeeping practices. Compliance with all infection prevention and control practices. Disinfection procedures. Spill response procedure. Reduction of the number of staff participating in the operation. Immunization program. Worker education. | PPE based on the risk assessment may include eye protection, gloves, respiratory protection and other protective clothing         |
| <b>Exposure to environmental biological contaminants from ventilation systems, water or food</b>  | Maintenance of ventilation systems. Preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning. Early detection and remediation of mould. | Infection prevention and control practices related to building maintenance and food preparation. Disinfection procedures. Protocols for construction and renovation projects that reduce contamination. Worker education.                                | Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection |
| <b>Exposure to laser plumes in surgical suites</b>  | Local exhaust ventilation. Selection of medical devices (lasers) that meet CSA standard.  | Policies and procedures to limit exposure. IPC policies and procedures.  | PPE based on the risk assessment may include eye protection, respiratory protection and other protective clothing                 |

## Notes about controls for biological hazards

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Exposure to biological hazards may occur for any medical and surgical caregivers in contact with patients. Controls include any mechanisms to reduce the potential for exposure to infectious agents and the immunization of all direct caregivers against infectious diseases to which they may be exposed.

### *Engineering Controls*

In the hierarchy of controls, the highest level of control is directed at the source. From an occupational health perspective, the highest level of control may be immunization of workers who may come in direct contact with infected patients. Good engineering controls such as proper design and maintenance of facilities, isolation rooms, the use of needleless systems and engineered needle stick prevention devices, and effective biological waste containment also contribute to minimizing the transmission of infectious agents. Engineering controls, once designed and implemented, are not under the control of the worker, but are directed at the source of the hazard.

### Safe Needle Devices

Safe needle devices have built-in engineering features that assist in preventing injuries during and after use of the device. Examples of safe needle devices that have built-in engineering features include:

- Needleless connectors for IV delivery systems
- Protected needle IV connectors
- Needles that retract into a syringe or vacuum tube holder
- Hinged or sliding shields attached to syringes
- Self-blunting phlebotomy and winged steel needles
- Blunt tip suture needles
- Retractable finger/heel-stick lancets

While some engineered safe needle devices have been available for some time, new engineered safe needle devices continue to be introduced for the healthcare industry. Sharps disposal containers assist in protecting HCWs from injuries when handling and transporting waste sharps. The CSA standard Z316.6-07 Evaluation of Single-use and Reusable Medical Sharps Containers for Biohazardous *and Cytotoxic Waste* should be consulted when selecting sharps containers.

### Isolation

In many health care facilities, patients with known or suspected infectious diseases are physically isolated from other patients to prevent transmission of infectious organisms. Isolation rooms must be specifically designed and constructed to protect the unique needs of patients who are placed in isolation as well as for HCW protection. Depending on the nature of the biological agents, the requirements for isolation rooms will vary in their physical design, furnishings, air handling systems and air pressurization of the room relative to adjacent areas.

### Negative pressure rooms

In addition to the requirements for isolation rooms used for droplet or contact isolation, negative pressure rooms may be required for patients with pathogens transmitted by the airborne route. These rooms should be well sealed to prevent the air from escaping into other areas. Anterooms should be incorporated as determined by assessment of risk. When isolating patients on airborne isolation, the design, operation and maintenance of air handling systems serving the room are critically important.



### Decontamination<sup>1</sup> of facilities and materials

Decontamination is a term used to describe procedures that remove contamination by killing microorganisms, rendering the items safe for disposal or use. Sterilization refers to the complete destruction or removal of all microorganisms by chemical or physical means, usually to provide sterile items for use. All contaminated materials must be decontaminated before disposal or cleaning for reuse. The choice of method is determined by the nature of the material to be treated. Disinfection refers to the destruction of specific types of organisms but not all spores, usually by chemical means. Disinfection is a means of decontamination. Surfaces must be decontaminated after any spill of potentially infectious materials and at the end of the working day. Work areas, patient rooms, and pieces of equipment may also require decontamination (i.e., prior to servicing, maintenance, between patients, transfer to other settings or reassignment).

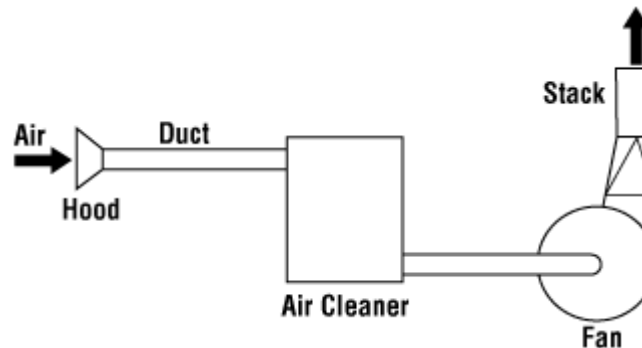
### Local exhaust ventilation

Local exhaust ventilation removes contaminants at the source where the contaminant originates and can be very effective at controlling health care worker (HCW) exposure. The components of a local exhaust system include a hood into which contaminated air flows, ducting for air to pass through, a fan to move the air, and an exhaust. For biological hazards, local exhaust ventilation is used in some instruments that create aerosols. The following figure<sup>2</sup> outlines the major components of a basic local exhaust ventilation system.

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<sup>1</sup> This section was modified from Laboratory Safety: CSMLS Guidelines, sixth edition; Gene Shematek & Wayne Wood; Canadian Society for Medical Laboratory Science; 2006.

<sup>2</sup> From CCOHS Publication *OSH Answers – Industrial Ventilation*; found at <http://www.ccohs.ca/oshanswers/prevention/ventilation/>. used with permission.



Examples of local exhaust ventilation include biological safety cabinets (BSCs) and capture devices on some surgical equipment, such as laser implements where a plume containing infectious material can be generated.

### General ventilation

General ventilation systems serving buildings must be maintained regularly and inspected for conditions that could adversely affect air quality provided to work spaces. Accumulations of water that could stagnate in humidification systems or drip trays are sources of potential biological contamination of air handling systems that need regular monitoring and inspection.

Biohazardous organisms may be carried through general ventilation systems, potentially distributing them to other workspaces in a facility. Ultraviolet germicidal irradiation units, and or HEPA filtration media incorporated into air handling systems may be warranted for special circumstances.

Mould growth in the indoor environment can be affected by relative humidity levels, which is a function of some general ventilation systems. High relative humidity levels may contribute to an increase in the growth of some moulds and lead to condensation developing on surfaces. Control of indoor relative humidity levels is an important factor in preventing mould growth.

### **Administrative Controls**

The next level of controls includes administrative controls. Because it is not always possible to eliminate or control the hazard at the source, administrative controls are frequently used for biological hazards in healthcare. Administrative controls focus on ensuring that the appropriate prevention steps are taken, that all proper work procedures are documented, that medical and surgical caregivers are trained to use the proper procedures, and that their use is enforced. Administrative controls include policies and procedures that establish expectations of performance, codes of practice, staff placement, required orientation and training, work schedules, and occupational health programs in which baseline immune status is recorded and immunizations are provided.

A comprehensive management system considers the continuum of infection prevention and control efforts across all sites and operations. It includes attention to patient, resident, visitor, contractor, volunteer and HCW safety. A comprehensive system should include the following components:

- A process that ensures comprehensive hazard assessments are conducted for all sites and tasks and appropriate controls are identified
- An infection prevention and control plan with clear designation of roles and responsibilities
- Coordinated activities and policies related to Infection Prevention and Control (IPC) and OHS that ensure a consistent approach to infection prevention and control for patients, visitors, residents and HCWs
- Consistent standards for the cleaning, disinfection and sterilization of equipment, procedures, and policies including Routine Practices, Additional Precautions, hand hygiene policies and facilities, patient risk assessments, communication protocols, decontamination of clothing and dedicated clothing
- Hands free or no touch techniques for the passing of instruments in the Operating Room
- Outbreak prevention and management
- Adequate staffing to comply with OHS and IPC policies and procedures; work scheduling; plans to address surge capacity
- Required orientation and ongoing education
- Biomedical waste handling procedures and policies
- Guidelines for infrastructure requirements to support effective IPC and OHS; the use of technical standards to ensure IPC is incorporated into new or renovated facilities
- Supporting systems that include Engineering/Physical Plant, Housekeeping, Materials Management and Facilities Planning to ensure:
  - Adequate housekeeping and waste management services
  - Appropriate processes for cleaning, decontamination, disinfection and sterilization of patient care equipment
  - Purchasing processes to include consideration of safety factors
- A comprehensive surveillance and monitoring plan
- Record keeping and regular reporting of outcomes

### *Routine practices and additional precautions*

Procedural controls may include procedures that relate to detection and follow-up of infectious diseases, the use of Routine Practices and Additional Precautions as directed, baseline health assessments and periodic screening of workers, hazard identification and control processes, and outbreak management procedures. Awareness of the infectious disease status of patients is another good control, though this is not always possible for medical and surgical caregivers. All work procedures should include the consideration

and control of the risk of exposure to workers. Routine Practices and Additional Precautions (where required) greatly assist in reducing the transmission of infectious agents from both known and unknown patient sources by treating all contacts as potential risks.

#### **Infection Prevention and Control Definitions:**

- **Routine Practices** include a recommended pattern of behaviours to form the foundation of limiting the transmission of microorganisms in all health care settings and is generally accepted care for all clients. Elements of Routine Practices are: hand hygiene; risk assessment related to client symptoms, care and service delivery, including screening for infectious diseases; risk reduction strategies through the use of PPE, cleaning environment, laundry, disinfection and sterilization of equipment, waste management, safe sharps handling, client placement and healthy workplace practices; and education of healthcare providers, clients and families, and visitors.
- **Additional precautions** are practices used to prevent transmission of infectious agents that are spread by direct or indirect contact with the client or client's environment that are necessary in addition to Routine Practices for certain pathogens or clinical presentations. These precautions include Contact Precautions, Droplet Precautions, and Airborne Precautions that are based on the method of transmission.

For more information: <http://www.health.alberta.ca/documents/IPC-MRSA-Standards-2008.pdf>

Routine Practices include being attentive to all routes of transmission. Awareness of routes of transmission has led to the development of a variety of transmission-route specific strategies. Most of these are well documented in infection prevention and control plans. In particular, hand hygiene is identified as the single most important administrative strategy in infection prevention and control. Other strategies include additional precautions designed to address infections transmitted through the "airborne" route, those transmitted through "droplets" and those transmitted through "contact". It should be noted that though some infection prevention and control plans appear to provide sharp demarcations as to what size of particle is transmitted by which route (particularly by airborne and droplet); it is highly likely that there is a continuum of particle sizes produced at any time and the determination of transmission route is more a probability than a certainty. For this reason, one must be careful in defining control strategies based solely on particle sizes.

In some circumstances, identification of the specific organism responsible for the infection may take considerable time, during which patient care is required. In these cases, it is prudent to apply the most stringent precautions until evidence indicates that less are required. In cases where the transmission route or organism has not yet been identified, it is prudent to assume all routes of transmission may be possible, as this would drive the highest level of precautions available and appropriate. Once more information is known about the organism, precautions can be revised to take that knowledge into account.

Administrative controls related to the prevention of exposure to biological hazards include the development and implementation of infection prevention and control guidelines, including vehicle and equipment decontamination and safe work procedures. Surfaces must be decontaminated after any spill of potentially infectious materials. Specific written protocols must be developed and followed for each decontamination process. Medical and surgical caregivers must be trained in all decontamination procedures specific to their activities and should know the factors influencing the effectiveness of the treatment procedure.

### Chemical Disinfectants

Chemical disinfectants are used to decontaminate surfaces, reservoirs of infectious material, and to clean up spills of infectious material. The choice of chemical disinfectant must be made carefully based on:

- Types of organisms, suspected or known
- Items or surfaces to be decontaminated
- Hazards posed to the HCW by the disinfectant
- Cost of disinfectant
- Corrosiveness of disinfectant
- Shelf life and required dilution of disinfectant
- Material which inactivates the disinfectant

In many cases, the choice of disinfectant for specific uses may be standardized in the organization and made after evaluation by IPC and OHS professionals.

#### Considerations in the use of chemical disinfectants

- As much as possible, know what the possible contaminants are.
- Choose the disinfectant carefully. More than one may be required. Keep in mind the items to be disinfected, and the properties and limitations of the various available disinfectants. If more than one disinfectant is required, ensure that those selected are chemically compatible.
- Follow the manufacturer's directions for making the proper dilutions of the disinfectants.
- The effective life of disinfectants can vary depending on the formulations and the conditions of usage. Follow the manufacturer's directions.
- The effective exposure time that the disinfectant must be in contact with the contaminant will also vary with conditions of usage. Often overnight exposure may be recommended to ensure effective decontamination.
- Understand the health and safety hazards that may be posed by a particular disinfectant and ensure appropriate precautions are taken. Wear disposable gloves when using any disinfectants. Wear other personal protective equipment or clothing as necessary, depending upon the disinfectants. Consult Material Safety Data Sheets for details.
- HCWs with particular sensitivities to specific disinfectants should avoid using those disinfectants.
- Perform tests of the disinfectants to ensure effective disinfection.

#### Spill response procedures

The efficient and effective control of a biological spill requires that all staff members are trained in and have practiced the established spill response techniques. The materials and supplies that are necessary for spill clean-up and decontamination must be readily available to ensure timely spill response. Written spill response procedures should outline spill response actions and roles. The actual procedure used will vary with the size of the spill and the location of spill (including materials, equipment or environmental surfaces affected). All spill responses should be documented as incidents.

#### A biological spill kit should contain:

- Biological liquid solidifying agent
- Disinfectant - small quantities, made fresh daily if phenolics or hypochlorites (such as bleach)
- Forceps for picking up broken glass
- Paper towels, swabs, disposable and heavy-duty gloves
- Metal or polypropylene (autoclavable) dust pan
- Heavy-duty polyethylene bags
- High efficiency particulate respirators, shoe covers or rubber boots and full protective clothing if large spills may occur

### Training

Training in biological hazards and controls should be provided to all health care workers (HCWs). Each HCW must understand the facility's IPC and OHS programs as they relate to their job duties. For newly hired HCWs all relevant IPC and OHS policies and procedures must be provided before they start work. To ensure that HCWs understand and apply this information to their jobs, specific training should also be provided to address job-specific biological hazards. Periodic refresher training to reinforce policies and procedures and introduce any new practices will benefit all HCWs. Competency assessments should be provided for all training, and training records should be maintained.

### HCW immunization and health surveillance

An immunization policy and program is a proactive mechanism to reduce risk of communicable diseases for HCWs. Each healthcare organization should have an immunization and health surveillance program in place that is appropriate to the size and type of workplace. Immunization and health surveillance programs should include:

- Education about vaccine-preventable diseases
- Risk assessment to determine the need for immunization or surveillance based on potential exposure
- Administration of immunizations (or referral for immunizations, as appropriate)
- Documentation and follow-up of any baseline health assessments, communicable disease status and immunizations

Ideally, the immunization and surveillance programs should provide easy, authorized access to HCW immune status records for follow up of exposure incidents and outbreaks. In some cases, immunizations or baseline testing may be required prior to commencement of work.

### Post-exposure follow-up management

Post-exposure management includes management of HCWs exposed to, colonized by, or infected with microorganisms; an outbreak management process for exposures and/or HCWs who are symptomatic or colonized with infectious disease; and access by Occupational Health professionals to utilize medical assessment and diagnostic services for timely follow-up for HCW exposures.

### Personal Protective Equipment (PPE)

Personal protective equipment such as gloves, respiratory protection and eye protection should be used based on the risk assessment. PPE is often used in conjunction with other controls (engineering and administrative) to provide additional protection to workers. The primary types of PPE are designed to protect the worker from infectious disease by breaking the chain of infection at the "portal of entry or exit" of the microorganisms. This means that all PPE is designed to reduce exposure via specific routes of

transmission. Gloves, gowns and other protective clothing reduce exposure through the dermal (skin) contact route and help contain the microorganisms to the work environment.

### Gloves

Gloves are the most common type of PPE used for medical and surgical tasks. Gloves are made from a variety of materials including latex, nitrile, neoprene, copolymer, and polyethylene and are available in various levels of thickness. When dealing with infectious materials, gloves must be waterproof. Most patient care activities require non-sterile gloves, whereas any invasive procedure should be performed using sterile surgical gloves. Latex gloves should be avoided due to the risk of latex allergy unless there is a demonstrated safety requirement for latex to be used. The Canadian General Standards Board (CGSB) certifies medical gloves, which is a key factor in selecting gloves for use in healthcare. The choice of gloves must often balance the needs for protection and dexterity. While thicker gloves (or double gloves) may appear to provide greater protection, it may make tasks more difficult and increase the exposure risk. In Recommendations for Canadian Health Care and Public Service Settings<sup>3</sup>, it is noted that the *“Selection of the best glove for a given task should be based on a risk analysis of the type of setting, type of procedure, likelihood of exposure to blood or fluid capable of transmitting bloodborne pathogens, length of use, amount of stress on the glove, presence of latex allergy, fit, comfort, cost, length of cuffs, thickness, flexibility, and elasticity.”*

#### **Safe Practices for Glove Use<sup>4</sup>**

- Wear medical gloves when there is a risk of contact with blood, body fluids or substances, mucous membranes, open wounds or skin lesions.
- Wear gloves that are certified by the CGSB.
- Wear gloves when handling items contaminated with blood, body fluids, secretions or excretions.
- Wear gloves if you have any cuts or lesions on your hands or if you have dermatitis affecting your hands.
- Avoid latex gloves and powdered gloves to reduce sensitization or allergic reactions.
- Ensure that the gloves fit properly.

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<sup>3</sup> Recommendations for Canadian Health Care and Public Service Settings; found at <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/97vol23/23s3/index.html>

<sup>4</sup> Modified from information provided in Preventing the Transmission of Blood Borne Pathogens in Health Care and Public Service Settings. Found at <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/97vol23/23s3/index.html> (See Supplement)



- Inspect gloves for holes or tears, discarding any damaged gloves.
- Put gloves on just before beginning the task, and remove them promptly when finished and before touching any environmental surfaces.
- Work from “clean to dirty” (touching clean sites or surfaces before dirty or contaminated ones).
- Do not touch your face or adjust PPE with contaminated gloves and avoid touching uncontaminated items such as light switches, telephones, etc. while wearing gloves.
- Change gloves when they become soiled, during lengthy procedures, and between patients.
- Remove gloves carefully according to the IPC guidelines and dispose of them properly.
- Wash hands before using and after removing gloves.
- Never reuse or wash single-use disposable gloves.

PPE is required when there is the potential for exposure of the face to splashes or sprays of infectious material. The selection of eyewear depends upon the tasks being conducted. Types of eye protection include safety glasses, goggles, visors, face shields and table mounted barrier shields. Regular prescription eyewear and contact lenses are not considered effective as PPE. Safety eyewear should fit the wearer, be clean and well maintained and stored. If necessary, goggles may be fitted with prescription lenses or worn over glasses. Face shields should cover the forehead, extend below the chin, and wrap around the side of the face. Masks protect the mucous membranes of the nose and mouth from exposure to large droplets that may contain infectious materials. Masks are commonly used to contain droplets at the source (for example, the HCW or patient with a cough). Masks should fully cover the nose and mouth and fit snugly. Masks worn by patients reduce exposure through droplet containment at the source, and respirators worn by health care workers reduce exposure to the respiratory system.

*The Difference between a Surgical or Procedure Mask and a Respirator*

| Surgical or Procedural Masks  | Respirators (i.e. NIOSH approved N95)   |
|---|---|
| <ul style="list-style-type: none"> <li>• Surgical Masks are <u>not</u> designed to seal tightly against the HCW's face or certified to prevent inhalation of small droplets/particles.</li> <li>• When the HCW inhales, contaminated small droplets can pass through gaps between the face and surgical mask.</li> </ul>  | <ul style="list-style-type: none"> <li>• A fit-tested NIOSH approved respirator provides a proper seal at the HCW's face, forcing inhaled air to be pulled through the filter material and not through gaps between the face and the respirator.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Surgical masks provide a physical barrier for protection from splashes of large droplets of blood or body fluids.</li> <li>• Surgical masks are used for several purposes including:               <ul style="list-style-type: none"> <li>○ Prevention of accidental contamination of patients wounds with pathogens normally present in mucus or saliva</li> <li>○ Placed on sick patients to limit spread of infectious respiratory secretions to others</li> <li>○ Protection from splashes or sprays of blood or body fluid</li> <li>○ Assist to keep HCWs contaminated hands from contacting their own mucous membranes.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Respirators are designed to reduce HCW's exposure to airborne contaminants.</li> <li>• Fit tested NIOSH approved respirators are used when required, based on hazard assessment.</li> </ul>                        |

\*Adapted from OSHA (2007) *Guidelines on Preparing Workplaces for an Influenza Pandemic*

## Pertinent legislation related to respiratory protection

### **Respiratory Protective Equipment**

If a worker is or may be exposed to exposure to an airborne biohazardous material, the employer must assess the work site to determine if workers need to use respiratory protective equipment (RPE) and provide worker the appropriate RPE where indicated.

For more information refer to: [http://employment.alberta.ca/documents/WHS/WHS-LEG\\_ohsc\\_p18.pdf](http://employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_p18.pdf)

OHS Code, Section 244

The employer must consider the nature and the exposure circumstances of any contaminants or biohazardous material. The employer must provide and ensure the availability of RPE appropriate to the worker's exposure circumstances. Where the hazard assessment identifies the need for RPE some of the requirements include:

#### **Training**

- Employer must ensure all workers receive appropriate education, instruction or training with respect to hazards they may be exposed to and procedures and controls used to reduce exposure.

#### **Code of Practice**

- If respiratory equipment is used at a work site, an employer must prepare a code of practice governing the selection, maintenance and use of the RPE. In the case of a health care worker who may be exposed to airborne biohazardous material, the code of practice includes training, done on at least an annual basis, on:

- information about the airborne biohazardous materials that workers may be exposed to including their potential health effects,
- the particular respiratory protective equipment used chosen, including information about its capabilities and limitations and how to test for a satisfactory fit, and
- how to properly put on and take off the RPE without contaminating oneself or other workers.

#### **Approval of Equipment**

- Employer must ensure that RPE required at a work site is approved by NIOSH or another standard setting and equipment testing organization, or combination of organizations, approved by a Director of Occupational Hygiene.

#### **Effective Face Seal**

- Employer must ensure that RPE that depends on an effective facial seal for its safe use is correctly fitted and tested in accordance with CSA standard (z94-4-02).

OHS Act, 33 and OHS Code, Part 18

## Chemical Hazards and Controls

This section will provide a brief overview of selected chemicals that medical and surgical caregivers may come into contact with.

**Note that this list is not extensive or all-inclusive.** In the control column, E, A and P are used to designate Engineering, Administrative and PPE controls. These controls are briefly summarized and the reader should link to the references provided for additional information. The proper choice of control measures must be based on a risk assessment for the specific tasks being performed. Safe work practices are administrative controls necessary for working with all harmful substances and educating workers in the practices is vital. Safe work procedures should be designed to:

- Limit the worker's exposure time
- Reduce contact with the substance through any route of exposure to the worker
- Ensure safe disposal of substances and disposable equipment that comes into contact with harmful substances
- Ensure safe handling and decontamination of reusable equipment
- Require the use of all designated controls

Worker education is critical for safely handling harmful substances.

### General Resources – Chemical Hazards

For more information about specific chemical hazards, consult the following resources:

NIOSH Pocket Guide to Chemical Hazards (<http://www.cdc.gov/niosh/npg/>).

CCOHS Cheminfo (<http://ccinfoweb.ccohs.ca/>).

Alberta Workplace Health and Safety Bulletins (<http://employment.alberta.ca/SFW/136.html> ).

The following charts, taken from Volume 3 – Best Practices for the Assessment and Control of Chemical Hazards in Healthcare, summarize important information about some of the chemical hazards that may be encountered by medical and surgical caregivers.

Chemicals used for cleaning and disinfection

| Chemical<br>(category or group)  | Common Uses<br>and Examples  | Exposure and Health<br>Effects Information   | Controls   | For more information:   |
|--|--|--|--|---|
| <p>These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.</p> |  |  |  |   |
| <b>Alcohol hand sanitizers</b>   | Hand hygiene when water is not available and hands are not visibly soiled  | May cause skin dryness. Product is flammable.  | <b>A-</b> Appropriate storage of product (away from ignition sources and incompatible products). Provision of hand cream to soothe hand dryness.   | <p><a href="http://www.ottawa.ca/residents/health/emergencies/pandemic/hand/faq_gel_en.html">http://www.ottawa.ca/residents/health/emergencies/pandemic/hand/faq_gel_en.html</a></p> <p><a href="http://employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf">http://employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf</a></p> <p><a href="http://www.municipalaffairs.alberta.ca/documents/ss/STANDATA/fire/fcb/97fcb026.pdf">http://www.municipalaffairs.alberta.ca/documents/ss/STANDATA/fire/fcb/97fcb026.pdf</a></p>                              |
| <b>Low Level Disinfectants</b>   | Chlorine compounds, alcohols, quaternary ammonium salts, iodophors, phenolic compounds, hydrogen peroxide used widely for disinfection; usually prepared and used in low concentrations. | Most are eye, skin, and respiratory irritants, particularly when concentrated. Some products may produce sensitization. Toxic effects depending on nature of chemical. May react with other products to create hazardous products. | <b>E-</b> Substitution with less harmful product. Properly designed and maintained ventilation systems. Automatic diluting machines. Closed systems.<br><b>A-</b> Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. Accommodation for sensitized workers or those with health issues.<br><b>P-</b> Gloves and eye protection. | <p><a href="http://ehs.virginia.edu/biosafety/bio_disinfection.html">http://ehs.virginia.edu/biosafety/bio_disinfection.html</a></p> <p><a href="http://www.cdc.gov/niosh/topics/chemical.html">http://www.cdc.gov/niosh/topics/chemical.html</a></p> <p><a href="http://cms.h2e-online.org/ee/hazmat/hazmatconcern/steril/">http://cms.h2e-online.org/ee/hazmat/hazmatconcern/steril/</a></p> <p><a href="http://www.mtpinnacle.com/pdfs/disinfectant-selection-guidelines.pdf">http://www.mtpinnacle.com/pdfs/disinfectant-selection-guidelines.pdf</a></p> |
| <b>Ethylene Oxide</b>  | Sterilization of medical devices. Exposure to ethylene oxide when removing   | Skin, eye and respiratory irritant. Toxic effects. Classified as a suspected human   | <b>E-</b> Substitution with less harmful product. Ensure processes adequately allow for ventilation of chambers. Local exhaust ventilation. Use of closed processes. Preventive maintenance on process   | <p><a href="http://www.cdc.gov/niosh/89115_52.html">http://www.cdc.gov/niosh/89115_52.html</a></p> <p><a href="http://www.osha.gov/SLTC/etools/hospital/central/central.html#Exposur">http://www.osha.gov/SLTC/etools/hospital/central/central.html#Exposur</a></p>   |

|                                   |  |   |  |  |
|-----------------------------------|--|---|--|--|
|                                   | items from the EtO sterilizer, moving items from the sterilizer to the aerator, and changing bottles of EtO gas. | carcinogen. Reproductive effects. May cause skin sensitization. May cause frostbite by skin contact. Inhalation exposure may result from improper aeration of Ethylene Oxide chamber or equipment malfunctions.     | equipment. Facility design. Leak alarms. <b>A-</b> Safe work procedures including emergency release procedures. Provision of sufficient time for aeration. WHMIS program and maintenance of MSDSs. Worker education. Control access to work area and process equipment. Continuous air monitoring in work and equipment service areas. Routine exposure monitoring. Accommodation for workers who are sensitized or may have health issues. <b>P-</b> Gloves, protective clothing (butyl apron), safety glasses, and appropriate respirator when changing cylinders or when engineering controls are insufficient.   | <a href="#">etoEthyleneOxideGas</a>  |
| <b>Glutaraldehyde</b>             | High level disinfection of medical devices. May also be used in tissue processing                                | Contact allergen, may cause occupational asthma and respiratory and skin sensitization. Ceiling Limit OEL exists. Strong skin and respiratory irritant. May react with other products to create hazardous products. | <b>E-</b> Substitution with less harmful product. Properly designed and maintained ventilation systems. Local exhaust ventilation. Enclosed processes. <b>A-</b> Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring. Accommodation for sensitized workers or those with health issues, <b>P-</b> Gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient. | <a href="http://www.osha.gov/Publications/3258-08N-2006-English.html">http://www.osha.gov/Publications/3258-08N-2006-English.html</a><br><a href="http://www.osha.gov/SLTC/etools/hospital/hazards/glutaraldehyde/glut.html">http://www.osha.gov/SLTC/etools/hospital/hazards/glutaraldehyde/glut.html</a><br><a href="http://www.cdc.gov/niosh/docs/2001-115/">http://www.cdc.gov/niosh/docs/2001-115/</a><br><a href="http://www.sustainablehospitals.org/cgi-bin/DB_Index.cgi">http://www.sustainablehospitals.org/cgi-bin/DB_Index.cgi</a> |
| <b>Ortho-phthalaldehyde (OPA)</b> | High level disinfection of medical devices. Replaces glutaraldehyde  | Eye and respiratory irritant and skin sensitizer. May cause skin discoloration. May react with other  | <b>E-</b> Properly designed and maintained ventilation systems. May require local exhaust ventilation. Enclosed processes. <b>A-</b> Practice to purchase products in  | <a href="http://www.mtpinnacle.com/pdfs/Cy dex.pdf">http://www.mtpinnacle.com/pdfs/Cy dex.pdf</a><br><a href="http://www.aspij.com/us/supports/material-safety-data-sheets">http://www.aspij.com/us/supports/material-safety-data-sheets</a>   |

|                            |  |  |  |   |
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|                            | containing disinfectants.  | products to create hazardous products.                     | ready to use concentrations to minimize handling. Safe work procedures including disposal and spill procedures, and keeping soaking containers closed at all times. WHMIS program and maintenance of MSDSs. Worker education. Control access to work area. Exposure monitoring. Accommodation for sensitized workers or those with health issues,<br><b>P-</b> Gloves, eye protection, face shield and chemical-resistant protective clothing. | <a href="http://www.sustainablehospitals.org/cgi-bin/DB_Index.cgi">http://www.sustainablehospitals.org/cgi-bin/DB_Index.cgi</a> |
| <b>Proteolytic enzymes</b> | Decontamination of biological material from endoscopes and surgical devices. | Sensitization of skin. Skin, eye and respiratory irritant. | <b>E-</b> Substitution with less harmful product or process. Enclosed processes.<br><br><b>A-</b> Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education.<br><br><b>P-</b> Gloves, face splash shields or procedure masks, moisture resistant gowns.   |   |

### Chemicals used in treatment

| Chemical  | Common Uses; Examples | Exposure and Health Effects Information | Controls                                 | For more information:   |
|---|-----------------------|---|--|---|
| These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls. |                       |   |  |   |
| <b>Anaesthetic</b>  | Used to induce        | Exposure is primarily                   | <b>E-</b> Substitution with less harmful | <a href="http://www.ccohs.ca/oshanswers/ch">http://www.ccohs.ca/oshanswers/ch</a> |

|   |   |   |   |   |
|---|---|---|---|---|
| gases <sup>5</sup>  | anaesthesia by inhalation in operating theatres; may off-gas in recovery rooms and ICUs   | through inhalation. Neurological and reproductive effects. Central nervous system depressant.   | products. Properly designed and maintained ventilation systems. Scavenging systems to control fugitive emissions. Properly designed patient masks and induction systems to reduce emissions.<br><b>A-</b> Safe work procedures. Preventative maintenance on equipment and systems. Routine exposure monitoring. Worker education.<br><b>P</b> – Respiratory protection based on hazard assessment.  | <a href="#">emicals/waste_anesthetic.html</a>   |
| <b>Antineoplastics, cytotoxic and other hazardous drugs, antibiotics, aerosolized drugs, hormonal drugs</b> | Antineoplastics used to treat cancer and other neoplasms; antibiotics and aerosolized drugs used to treat infections. Examples – cancer treatment drugs, aerosolized pentamidine or ribavirin | May be mutagenic or carcinogenic, teratogenic or have reproductive effects, or affect target organs. Exposure may occur through inhalation, skin contact, skin absorption, ingestion, or injection. Inhalation and skin contact/absorption exposures may occur when reconstituting or making up the drug, administering the drug, handling contaminated materials, and disposing of drugs or contaminated materials, including patient waste. | <b>E-</b> Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.<br><b>A-</b> Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Accommodation for workers with special needs (pregnant workers, persons with sensitivities or other health issues). | <a href="http://www.cdc.gov/niosh/docs/2004-165/2004-165b.html#j">http://www.cdc.gov/niosh/docs/2004-165/2004-165b.html#j</a><br><a href="http://www.cdc.gov/niosh/topics/hazdrug/">http://www.cdc.gov/niosh/topics/hazdrug/</a><br><a href="http://www.cdc.gov/niosh/docs/2004-165/">http://www.cdc.gov/niosh/docs/2004-165/</a><br><a href="http://www.cdc.gov/niosh/topics/antineoplastic/">http://www.cdc.gov/niosh/topics/antineoplastic/</a><br><a href="http://www.mtpinnacle.com/pdfs/safe-handling-hazardous-drugs.pdf">http://www.mtpinnacle.com/pdfs/safe-handling-hazardous-drugs.pdf</a><br><a href="http://www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html">http://www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html</a><br><a href="http://www.ashp.org/DocLibrary/BestPractices/PrepGdlHazDrugs.aspx">http://www.ashp.org/DocLibrary/BestPractices/PrepGdlHazDrugs.aspx</a> |

<sup>5, 23</sup> Information from linked sources plus Essential of Modern Hospital Safety, Volume 3, William Charney, ed. 1994, CRC Press, ISBN 1-56670-083-3.



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|--|--|--|--|---|
|  |  |  | <p><b>P-</b> Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.</p> | <p><a href="http://www.osha.gov/dts/tib/tib_data/tib20011221.html">http://www.osha.gov/dts/tib/tib_data/tib20011221.html</a></p> <p><a href="http://www.irsst.qc.ca/en/_publicatio_nirsst_100390.html">http://www.irsst.qc.ca/en/_publicatio_nirsst_100390.html</a></p> |
|--|--|--|--|---|

### Chemical Wastes

| Chemical   | Common Uses; Examples  | Exposure and Health Effects Information   | Controls   | For more information:   |
|--|--|---|--|---|
| <p>These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.</p> |  |   |  |   |
| <b>Laser plumes / Surgical smoke</b>   | By-product of the use of lasers and electrocautery devices for surgical procedures | Plumes may contain toxic vapours and gases, including benzene, formaldehyde, and hydrogen cyanide (in addition to biological hazards). Depending on waste by-products, exposure may cause respiratory and eye effects, and may be toxic to specific organs. | <p><b>E-</b> Well-designed smoke evacuation systems situated in proximity to plume. Availability of smoke evacuation systems in all areas where plumes can be generated. Adequate ventilation.</p> <p><b>A-</b> Requirement to use smoke evacuation systems whenever any sized plume is generated. Safe work procedures. Education of workers in the nature of the hazard. Preventative maintenance of systems. Adherence to CSA Standard Z305.13-09, <i>Plume scavenging in surgical, diagnostic, therapeutic and aesthetic settings</i>.</p> <p><b>P-</b> Gloves, eye, face and respiratory protection based on hazard assessment.</p> | <p><a href="http://www.osha.gov/SLTC/etools/hospital/surgical/surgical.html#LaserPlume">http://www.osha.gov/SLTC/etools/hospital/surgical/surgical.html#LaserPlume</a></p> <p><a href="http://www.cdc.gov/niosh/hc11.html">http://www.cdc.gov/niosh/hc11.html</a></p> |
| <b>Waste anaesthetic gases</b>   | Used to induce anaesthesia in operating theatres; may off-gas in                   | Exposure is primarily through inhalation. Neurological and reproductive effects.  | <p><b>E-</b> Substitution with less harmful products. Properly designed and maintained ventilation systems. Control of fugitive emissions with scavenging systems. Properly designed patient</p>   | <p><a href="http://www.ccohs.ca/oshanswers/chemicals/waste_anesthetic.html">http://www.ccohs.ca/oshanswers/chemicals/waste_anesthetic.html</a></p>  |

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|  | recovery rooms and ICUs |  | masks and induction systems to reduce emissions.<br><b>A-</b> Safe work procedures. Preventative maintenance on equipment and systems. Routine exposure monitoring. Worker education. |  |
|--|-------------------------|--|---|--|

Other chemicals and substances

| Chemical  | Common Uses; Examples   | Exposure and Health Effects Information  | Controls   | For more information:   |
|---|---|--|--|---|
| These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls. |   |  |  |   |
| <b>Chemicals used in terrorist activities</b>   | A variety of chemicals that could be used in terrorist activities. May be encountered while caring for exposed patients and result in contamination of the healthcare environment | Depending upon the nature of the chemical, its concentration and route of exposure, may cause blistering, choking, neurological or blood system effects.                         | <b>E</b> – Properly designed and maintained ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Provision of adequate decontamination facilities. Provision of antidotes if available.<br><b>A</b> – Development and implementation of a chemical, biological, radiological and nuclear response (CBRN) plan. Education of workers in the nature of the hazard and emergency procedures.<br><b>P</b> – PPE as detailed in the CBRN plans. | <a href="http://www.aiph.org/cgi/reprint/91/5/718.pdf">http://www.aiph.org/cgi/reprint/91/5/718.pdf</a><br><br><a href="http://www.nae.edu/File.aspx?id=11311">http://www.nae.edu/File.aspx?id=11311</a>  |
| <b>Compressed gases</b>   | Commonly used for patient treatment i.e. oxygen, nitrous oxide. Also commonly used in maintenance activities. Liquid nitrogen   | Asphyxiation, anaesthetic effects. Toxicity is dependant on chemical products. Other hazards include explosions, fire hazards, flying projectiles, and release of gas. Cryogenic | <b>E-</b> Substitution with less harmful product. Adequate ventilation. Proper storage of cylinders.<br><b>A-</b> Appropriate store of products to decrease exposure and minimize fire and explosion hazards. Safe work procedures including transportation. WHMIS program and maintenance of MSDSs. Worker education. Good  | <a href="http://www.ccohs.ca/oshanswers/chemicals/compressed/compress.html">http://www.ccohs.ca/oshanswers/chemicals/compressed/compress.html</a><br><br><a href="http://www.ccohs.ca/oshanswers/prevention/comp_gas.html">http://www.ccohs.ca/oshanswers/prevention/comp_gas.html</a><br><br><a href="http://www.chem.ubc.ca/safety/safety_manual/hazard_chem_gases.shtml">http://www.chem.ubc.ca/safety/safety_manual/hazard_chem_gases.shtml</a> |

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|                            | is used for tissue preservation and cryo-treatment (e.g. wart removal)   | gases may also cause skin damage through freezing.  | housekeeping.<br><b>P-</b> PPE based on hazard assessment.   |   |
| <b>Latex</b>               | Used in gloves, medical devices, some respirators, elastic bands, balloons, etc.   | Exposure can produce irritant contact dermatitis, allergic contact dermatitis, and allergic responses including immediate hypersensitivity and shock.                                   | <b>E-</b> Substitution with less harmful product. Properly designed and maintained ventilation systems.<br><b>A-</b> Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present. As per hazard assessment.   | <a href="http://www.worksafebc.com/publications/health_and_safety/by_topic/asets/pdf/latex_allergies.pdf">http://www.worksafebc.com/publications/health_and_safety/by_topic/asets/pdf/latex_allergies.pdf</a><br><br><a href="http://www.ccohs.ca/oshanswers/diseases/latex.html?print">http://www.ccohs.ca/oshanswers/diseases/latex.html?print</a>  |
| <b>Mercury</b>             | Metallic mercury may be found in thermometers, pressure gauges (manometers), other medical devices and dental fillings, etc. | Exposure is through inhalation of vapours, ingestion and skin absorption. Skin sensitizer. Corrosive as liquid. Target effects to the nervous system, kidneys, cardiovascular and eyes. | <b>E-</b> Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Properly designed and maintained ventilation systems. Local exhaust ventilation may be required.<br><b>A-</b> Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of the work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.<br><b>P-</b> Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment. | <a href="http://employment.alberta.ca/documents/WHS/WHS-PUB_ch003.pdf">http://employment.alberta.ca/documents/WHS/WHS-PUB_ch003.pdf</a><br><br><a href="http://www.cdc.gov/niosh/npg/npgd0383.html">http://www.cdc.gov/niosh/npg/npgd0383.html</a><br><br><a href="http://www.mtpinnacle.com/pdfs/MERCURY-USE-%20HOSPITALS-AND-CLINICS.pdf">http://www.mtpinnacle.com/pdfs/MERCURY-USE-%20HOSPITALS-AND-CLINICS.pdf</a> |
| <b>Methyl methacrylate</b> | Surgical and dental prosthesis   | Eye, skin and mucous membrane irritant.<br>Central nervous system   | <b>E-</b> Substitution with less harmful product. Properly designed and maintained ventilation systems. Enclosed mixing  | <a href="http://www.cdc.gov/niosh/npg/npgd0426.html">http://www.cdc.gov/niosh/npg/npgd0426.html</a>   |

|  |  |   |   |  |
|--|--|---|---|--|
|  |  | and cardiac effects.<br>Skin sensitizer.  | devices. Local exhaust ventilation.<br><b>A-</b> Safe work procedures. Good hygiene practices. Education of workers in the nature of the hazard. WHMIS program and maintenance of MSDSs. Medical monitoring of workers.<br><b>P-</b> Gloves, eye protection and face shields. Respirators based on hazard assessment. | <a href="http://www.cdc.gov/niosh/hcwold5b.html">http://www.cdc.gov/niosh/hcwold5b.html</a><br><a href="http://www.cdc.gov/niosh/npg/npgd0426.html">http://www.cdc.gov/niosh/npg/npgd0426.html</a> |
| <b>Personal care products, scents and fragrances</b> | A wide range of products including personal care items such as shampoos, soaps, perfumes, creams, deodorants, etc. Also contained in, cleaning products. | May cause a variety of mild to severe symptoms. Allergic, asthmatic and sensitive workers may experience reactions. | <b>E-</b> Elimination of scented products. Substitution with less harmful products. Properly designed and maintained ventilation systems.<br><b>A-</b> Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker education.                       | <a href="http://www.ccohs.ca/oshanswers/hsprograms/scent_free.html">http://www.ccohs.ca/oshanswers/hsprograms/scent_free.html</a>  |

In this section the most common potential chemical exposure hazards encountered by medical and surgical caregivers and methods to control them are presented. Employers should carefully evaluate the potential for exposure to chemical hazards in all medical and surgical tasks and ensure that they have an effective hazard control plan in place. This information will be useful for inclusion into hazard assessments. Please note, this is not designed to be an exhaustive treatment of the subject, but is rather an overview summarizing the chemical hazards most frequently encountered by medical and surgical caregivers.

**Note:**

The following charts taken from Volume 3 – Best Practices for the Assessment and Control of Chemical Hazards in Healthcare provide basic information about control strategies for commonly occurring chemical hazards related to medical and surgical tasks. The selection of controls must be based on a risk assessment of the tasks and environment. Worker education and good communication processes are critical administrative controls. All legislation related to the assessment of hazards, selection and use of controls must be followed.

| Potential Chemical Hazards   | Summary of Major Control Strategies  |  |   |
|--|--|--|---|
|  | Engineering  | Administrative   | PPE   |
| <b>Exposure to disinfectants used for cleaning purposes</b>  | Maintain adequate general ventilation. Automatic diluting machines.  | Purchase in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.  | Gloves and eye protection.  |
| <b>Exposure to hazardous drugs through administration, clean-up or spill response procedures</b>       | Proper containment when preparing drugs. Engineered needle stick prevention devices. Maintain adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items. | Develop safe work procedures with consideration to the specific product and manufacturer's instructions. Develop waste handling procedures. Educate workers in the nature of the hazard. Maintain availability of appropriate equipment and PPE.   | Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators, based on risk assessment, may be required for administration of aerosolized drugs, unpacking of cytotoxic drugs, splitting and crushing, spill and waste cleanup, etc. . |
| <b>Contact with mercury through broken mercury-containing devices</b>                                  | Elimination of mercury containing equipment. Substitution with less harmful product. Enclose mercury sources. Maintain adequate general ventilation.   | Safe work procedures including spill procedures. Educate workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitor work environment following a spill. Ensure good hygiene practices. Store products appropriately to decrease exposure. | Protective clothing, gloves, eye protection, and respiratory protection.  |
| <b>Exposure to latex from contact with latex gloves or components of medical devices</b>               | Substitution with less harmful product. Maintain adequate general ventilation.   | Purchasing controls to limit latex containing materials from entering facility. Educate workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Periodic screening of workers.  |   |
| <b>Exposure to a variety of cleaning agents in routine cleaning activities related to patient care</b> | Maintain adequate general ventilation. Automatic diluting machines.  | Purchase in ready to use concentrations to minimize handling. Safe work procedures.  | Gloves and eye protection.  |

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| <b>Exposure to scented products that may induce sensitization</b>   | Elimination of scented products. Substitution with less harmful products. Maintain adequate general ventilation.   | Develop scent-free policies. Educate worker in the nature of the hazard. Post signage in work areas where affected workers work.   |  |
| <b>Exposure to ethylene oxide during off-gassing of sterilized items</b>  | Substitution with less harmful product. Maintain adequate general ventilation. Consider facility design.   | Safe work procedures. Provision of sufficient time for aeration. Continuous air monitoring in work and equipment service areas.  | Chemical-resistant gloves, protective clothing.                                |
| <b>Exposure to anaesthetic gases through poor ventilation, leaks, or from off-gassing from patients</b>                           | Substitution with less harmful products. Maintain adequate general ventilation. Control fugitive emissions with scavenging systems. Provide properly designed patient masks to reduce emissions. | Safe work procedures. Perform preventative maintenance on equipment and systems. Perform routine occupational hygiene monitoring to evaluate worker exposure.  |  |
| <b>Exposure to methyl methacrylate used to secure prostheses to bone during orthopaedic surgery</b>                               | Substitution with less harmful product. Maintain adequate general ventilation. Enclosed mixing devices. Local exhaust ventilation.   | Develop safe work procedures. Maintain good hygiene practices. Educate workers in the nature of the hazard. Medical monitoring of workers.   | Gloves, eye protection and face shields. Respirators based on risk assessment. |
| <b>Exposure to hydrogen peroxide used as a cold sterilant</b>   | Substitution with less harmful product. Maintain adequate general ventilation. May require local exhaust ventilation. Enclose processes.   | Purchase in ready to use concentrations to minimize handling. Safe work procedures.  | Gloves, eye protection and chemical-resistant protective clothing.             |
| <b>Exposure to chemicals in laser plumes (biological agents may also be present and are discussed in Volume 2 of this series)</b> | Well-designed smoke evacuation systems situated in close proximity to plume. Availability of smoke evacuation systems in all areas where plumes can be generated. Maintain                       | Require smoke evacuation systems to be used whenever any sized plume is generated. Develop safe work procedures. Educate workers in the nature of the hazard. Perform preventative maintenance of systems. | Gloves, eye, face and respiratory based on risk assessment.                    |

|   |  |   |   |
|---|--|---|---|
|   | adequate general ventilation.  |   |   |
| <b>Exposure to vehicle exhaust from ambulances</b>  | Maintain adequate general ventilation. Local exhaust ventilation in ambulance bays where possible. Install emission control devices. Facility design to control exhaust build up and migration especially location of facility air intakes.  | Develop polices and procedures that require vehicle engines to be shut off in loading areas and in proximity to facility air intakes. Maintain vehicles to reduce emissions. Educate workers in the nature of the hazard. | PPE not typically required however, based on hazard assessment PPE may be required including respirators, protective clothing, gloves, eye and face protection. |
| <b>Exposure to chemicals used in terrorist activities through contact with patients contaminated with chemical agents</b> | Maintain adequate general ventilation. Local exhaust ventilation. Isolate areas where contamination may be present. Provide adequate decontamination facilities. Provide antidotes if available.   | Develop and implement chemical, biological, radiological and nuclear response (CBRN) plan. Educate workers in the nature of the hazard and emergency procedures.  | PPE as detailed in the CBRN plans.  |
| <b>Exposure to a variety of chemicals that may contaminate patients or their clothing</b>                                 | Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Maintain adequate general ventilation. Local exhaust ventilation. Isolate areas where contamination may be present. Provide adequate decontamination facilities. | Safe work procedures. Educate workers in the nature of the hazard and work procedures. Triage procedures. Communication between first responders and site where patient was exposed.                                      | PPE as required based on risk assessment. Refer to individual MSDSs and the links provided.   |

## Notes about controls for chemical hazards

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### *Engineering Controls*

Many engineering controls are available for controlling the hazard at the source and along the path of transmission. For chemical hazards, common engineering controls include:

- Elimination
- Substitution
- Local exhaust ventilation
- General ventilation (only appropriate for non-toxic chemicals)
- Isolation/enclosed processes
- Proper chemical storage
- Facility design

For medical and surgical caregivers, chemical exposures may be limited by ensuring the facilities well designed, have effective ventilation, adequate storage for any chemicals used and have easily cleanable surfaces.

### *Elimination*

Elimination of a hazardous chemical from the healthcare workplace is always desirable but not always possible. For example, drugs must still be prepared and administered, anaesthetic gases must be used for surgeries, disinfectants are required when biological hazards are present, cleaning solutions are necessary to maintain hygienic conditions, and laboratory reagents are required for performing diagnostic tests. In some cases, exposures can be eliminated by transferring specific processes or activities to another facility, or areas within a facility where better controls are available.

Some examples of elimination of chemical hazards in healthcare:

- Purchasing fragrance-free products.
- Using non-chemical means of sterilization (thermal).

### *Substitution*

Some chemicals used in the healthcare environment are chosen based on tradition or cost. In recent years, efforts have been made to find less hazardous alternatives to some of the chemicals commonly used.



Some examples of substitution of chemical hazards in healthcare:

- Replacing mercury-containing devices (manometers, thermometers) with non-mercury containing alternatives.
- Using accelerated hydrogen peroxide-based disinfectants instead of glutaraldehyde.
- Using hydrogen peroxide-based cleaners rather than chlorine- based cleaners.

When substituting a chemical for one that is currently in use, it is critical to ensure that the new chemical does not have properties that may make it more toxic or more flammable, etc.

### Local Exhaust Ventilation

The most common engineering control used in healthcare to minimize exposure to chemicals in the air is local exhaust ventilation (LEV). LEV captures contaminants at the point where they are released or generated and mechanically removes them before workers can inhale them.

Examples of uses of local exhaust ventilation in healthcare:

- Scavenging systems are used in operating rooms to ensure that workers are not exposed to elevated levels of waste anaesthetic gases.
- Dedicated local exhaust is used over instruments soaking in glutaraldehyde.
- Methyl methacrylate is handled with local exhaust ventilation by dental technicians and workers making orthopaedic casts and prosthetic devices.
- The ethylene oxide chamber is ventilated and ventilated exhaust hoods are placed above the sterilizer doors where ethylene oxide is used (surgical processing).

## **Administrative Controls**

### Policies and procedures, training

As administrative controls, policies and procedures should be in place to ensure that there are safe work procedures for storing and using chemicals and discarding chemical wastes appropriately. Medical and surgical caregivers may come into contact with a number of chemicals through exposure to patients contaminated with chemicals, as well as chemicals that may be present used in treatment and disinfection procedures. Workplace Hazardous Materials Information System (WHMIS) training should be provided to all medical and surgical caregivers. In addition, emergency call lines that provide expertise and advice regarding toxic chemicals should be made available.

### WHMIS Program

A WHMIS (Workplace Hazardous Materials Information Management System) program is an administrative control to reduce the risk of exposure to chemicals in the workplace and is a legal requirement for all employers who use controlled products in Alberta. To be effective, a WHMIS program must be relevant to the workplace, presenting information and training specific to the chemicals that are used in the workplace. The components of WHMIS include having current Material Safety Data Sheets for all products in the workplace, ensuring all products are appropriately labelled and ensuring that all workers are instructed on how to use the chemicals safely.

### Occupational Hygiene Program

To ensure effective identification and control of chemical hazards, an occupational hygiene program should be in place. An occupational hygiene program provides the framework for routine exposure monitoring of chemical hazards in the workplace that may reach exposure levels known to cause illness or injury. All employers must understand the legal responsibilities to identify and control hazards.

### Exposure follow-up – emergency response equipment

Two types of exposure follow-up are considered as administrative controls. The first is the provision of appropriate emergency response equipment to reduce the impact of the exposure. The second is the medical follow-up for workers who have had a chemical exposure. In the first case, emergency response equipment for medical and surgical caregivers usually refers to emergency eyewashes that can provide sufficient water to dilute the contaminant before it can cause extensive damage. Wherever chemical exposure could pose a hazard to eyes and skin, emergency wash devices are required. Appropriate signage that is easily visible must be provided to indicate where the eyewashes are kept.

### Medical follow-up of the exposed worker

A worker who has had a chemical exposure may require medical follow-up. Guidelines are available to provide information on the treatment and monitoring of workers with exposure to specific chemicals.

### Health Surveillance and Medical Monitoring in the Workplace

Health surveillance encompasses two types of individual health assessments. The pre-placement assessment considers the worker's personal health status as it relates to potential workplace exposures. It is useful to identify if workers have any allergies or sensitivities to products that they may need to work with. Another form of health surveillance is the on-going biological monitoring of workers who are exposed to certain chemicals or drugs in the workplace. In some cases, healthcare organizations establish medical surveillance programs to monitor potential exposures to hazardous drugs.

### Chemical Waste Handling and Disposal

Chemical wastes must be addressed with a good chemical waste management system. Municipal and or Provincial codes address appropriate disposal requirements and aim to reduce contamination, possible injuries, illness or reactions related to chemical exposures.

### Additional considerations for reducing risk of exposure

It is prudent to be aware of the need for modification of the work environment, conditions or required PPE for workers who may be medically vulnerable to the effects of some substances. Higher risk workers may include pregnant workers, workers with allergies or those who are sensitized to certain chemicals. Some common approaches to accommodate these workers include temporary reassignment to areas or tasks where the exposure potential is eliminated; work scheduling to reduce the amount of exposure, and changes to the PPE to accommodate limitations.

### **Personal Protective Equipment**

Personal protective equipment (PPE) is considered the lowest level of protection in the hierarchy of controls. This reflects the reliance on proper selection, fit, use and maintenance of the equipment by the organization and individual HCWs. PPE is often used in conjunction with other controls (engineering and administrative) to provide additional protection to workers. PPE is designed to protect the worker from exposure to chemicals by blocking access to the route of entry into the body. Gloves, aprons and other protective clothing reduce exposure through the dermal (skin) contact route. Eye and face protection reduce exposure through skin and mucous membrane contact. Respirators reduce exposure to the respiratory system.

### Gloves

The most frequently used PPE by HCWs to prevent exposure to chemicals is gloves. When choosing gloves, the following must be considered:

- The nature and concentration of the chemicals
- The amount of time the gloves will be exposed to the chemical
- Dexterity required to perform the task

- Extent of protection needed (to wrist or higher)
- Decontamination and disposal requirements

#### Rules for glove use for chemicals<sup>7,8</sup>

- Wear the appropriate gloves for the task when needed; for reusable gloves, follow the manufacturer's guidelines for care, decontamination and maintenance. Choose gloves resistant to holes and tears.
- Ensure gloves fit properly and are of the appropriate thickness to offer protection; ensure adequate supplies of gloves in appropriate sizes.
- Avoid using latex gloves (due to latex allergies).
- Do not use worn or defective gloves.
- Wash hands once gloves have been removed.
- Disposable gloves must be discarded once removed. Do not save for future use.
- Dispose of used gloves into the proper container. Have separate disposal locations for gloves contaminated with chemicals which pose a toxic hazard if mixed.
- Non-disposable/reusable gloves must be washed and dried, as needed, and then inspected for tears and holes prior to reuse.
- Remove gloves before touching personal items, such as phones, computers, pens and one's skin.
- Do not wear gloves into and out of areas. If gloves are needed to transport anything, wear one glove to handle the transported item. The free hand is then used to touch door knobs, elevator buttons, etc.
- Do not eat, drink, or smoke while wearing gloves. Gloves must be removed and hands washed before eating, drinking, or smoking.
- If for any reason a glove fails, and chemicals come into contact with skin, remove the gloves, wash hands thoroughly and obtain first aid or seek medical attention as appropriate.

#### Eye and Face Protection

For most HCWs who use chemicals, goggles or face shields are necessary. In most cases, goggles are considered re-usable. All reusable PPE must be properly decontaminated and maintained. Selection of protective eyewear should take into account:

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<sup>7</sup> OSH Answers- Chemical Protective Clothing – Gloves; <http://www.ccohs.ca/oshanswers/prevention/ppe/gloves.html>

<sup>8</sup> Glove Use in Laboratories; University of Florida Chemical Hygiene Plan; <http://www.ehs.ufl.edu/Lab/CHP/gloves.htm>

- Level of protection required
- Comfort of the wearer
- Secure fit that does not interfere with vision or movement
- Ease of cleaning and disinfection
- Durability
- Compatibility with prescription glasses and other PPE that must be worn at the same time (e.g. respirators)

### Respirators

According to the Alberta Occupational Health and Safety Code 2009<sup>9</sup>, there is a duty to provide and use respiratory protective equipment (RPE) when a hazard assessment indicates that a worker may be exposed to airborne contaminants or exposed to an oxygen deficient environment. Employers are required to use engineering and administrative controls before using RPE (respecting the hierarchy of controls). Respirators may be required to protect HCWs from exposure to chemicals by inhalation.

#### **Respiratory Protective Equipment (RPE)**

Employers must determine the degree of danger presented by respiratory hazards and whether workers need to wear RPE if workers are, or may be exposed to, an airborne harmful substance. The employer must consider the nature and the exposure circumstances of the harmful material. If a hazard assessment identifies the need for RPE, the specific legislated requirements are outlined in the *OHS Code, Part 18*.

Some of the requirements include:

##### **Training**

- Employers must ensure that all workers receive appropriate education, instruction or training with respect to hazards that they may be exposed to and procedures and controls used to reduce exposure.

##### **Code of Practice**

- If respiratory equipment is used at a work site, an employer must prepare a written code of practice governing the selection, maintenance and use of the RPE.

##### **Approval of Equipment**

- Employers must ensure that RPE required at a work site is approved by NIOSH or another standards setting and equipment testing organization, or combination of organizations, approved by a Director of Occupational Hygiene.

<sup>9</sup> Alberta OHS Code 2009, Part 18 – Personal Protective Equipment

**Effective Face Seal**

- Employers must ensure that RPE that depends on an effective facial seal for its safe use is correctly fitted in accordance with CSA standard Z94.4-02 or a method approved by a Director of Occupational Hygiene.

*OHS Act, Section 33 and OHS Code, Part 18*

**Protective Clothing**

Chemical protective clothing is available as gowns, aprons, uniforms, coveralls, foot covers and full body suits. The choice of protective clothing relies on an accurate hazard assessment. Should protective clothing become contaminated with a chemical or damaged, the clothing must be removed and handled according to organizational procedures (disposal or proper decontamination). Residual chemicals such as acids on clothing may continue to present an exposure hazard. Workers must not wear clothing that is contaminated with chemicals home, as this may pose a danger to themselves and others.

**Worker Decontamination**

If a worker is contaminated by a harmful substance at the worksite, the employer must ensure that only those items that have been properly decontaminated or cleaned are taken from the worksite by the worker.

## Physical Hazards and Controls

There are many potential physical hazards to which medical and surgical caregivers may be exposed. The nature of the work may pose ergonomic hazards, the potential for slips, trips and falls, exposure to environmental conditions, driving hazards, hazards related to the storage and use of compressed gas cylinders, cuts, and electrical hazards.

In this section the physical hazards most commonly encountered by medical and surgical caregivers and methods to control them are presented. Employers should carefully evaluate the potential for exposure to hazards for all medical and surgical tasks and ensure that they have an effective hazard control plan in place. This information will be useful for inclusion into hazard assessments.

**Note:**

The following chart provides basic information about control strategies for commonly occurring physical hazards in medical and surgical work. The selection of controls must be based on a risk assessment of the tasks and environment. Worker education and good communication processes are critical administrative controls. All legislation related to the assessment of hazards, selection and use of controls must be followed.

| Potential Physical Hazards  | Summary of Major Control Strategies  |  |  |
|---|--|--|--|
|   | Engineering  | Administrative   | PPE  |
| <b>Ergonomic hazards associated with patient handling</b><br><br><b>Refer to the “No Unsafe Lift Workbook” at <a href="http://employment.alberta.ca/documents/WHS/WHS-PUB_nounsafelift_workbook.pdf">http://employment.alberta.ca/documents/WHS/WHS-PUB_nounsafelift_workbook.pdf</a></b> | Availability of adequate sizes and types of patient handling equipment.<br>Ergonomic criteria incorporated into facility design. | A comprehensive patient handling program that incorporates the principles of the “No Unsafe Lift Workbook”.<br>Safe work procedures for patient handling activities.<br>Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of ergonomic concerns. Stretches and micro-breaks. Purchasing standards for patient handling | Appropriate footwear with gripping soles and good support. |

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|   |  | equipment. Maintenance of patient handling equipment.  |
| <b>Ergonomic hazards associated with computer use or workstation design</b>   | Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstation to accommodate shared use by employees of various sizes.   | Adjustment of workstation and chair to fit user. Worker education regarding ergonomic hazards and control strategies. Self assessment tools to assist workers in identifying and controlling risk factors. Safe work procedures. Early reporting of signs and symptoms of ergonomic concerns. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment. |
| <b>Ergonomic hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.</b> | Ergonomically designed storage areas with adequate space. Ergonomically designed equipment and furniture with appropriate casters and handles. Provision of appropriate materials handling equipment such as carts, trolleys, etc. | Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of ergonomic concerns. Stretches and micro-breaks. Purchasing standards for ergonomically designed equipment, furniture and supplies. Purchasing standards for material handling equipment. Maintenance program for equipment and furniture.  |
| <b>Ergonomic hazards associated with positioning and holding limbs, equipment, etc.</b>   | Ergonomically designed equipment to mechanically support limbs.  | Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and  |



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|  |  | symptoms of ergonomic concerns. Stretches and micro-breaks. Job rotation.  |  |
| <b>Ergonomic hazards associated with awkward and sustained postures (e.g. prolonged standing and forward bent head/neck)</b> | Ergonomically designed instruments and equipment. Adjustable height work surfaces. Use of a foot rest or bar to improve lower back comfort while standing. Appropriate lighting.   | Safe work procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of ergonomic concerns. Stretches and micro-breaks. Job rotation.  | Appropriate footwear.  |
| <b>Exposure to ionizing radiation during therapeutic radiology</b>   | Workplace design to provide distance between worker and source. Appropriate shielding materials (permanent where possible). Immobilizing devices to restrain/position patients. Audible signals on machines when exposure is ended. Interlock systems. | Radiation safety program. Worker education. Safe work procedures to reduce exposure time (procedures requiring fewer workers in area, use fast film speed and short exposure times, etc.). Scheduling. Radiation safety program. Exposure monitoring program         | Lead gloves, aprons, etc. as required.   |
| <b>Exposure to ionizing radiation through administration of radioactive therapeutic agents</b>                               | Use of needlestick prevention devices. Shielding in the preparation of reagents, therapeutic agents  | Radiation safety program. Worker education. Safe work procedures (proper labelling of all substances, proper disposal of all waste products, etc.) Reassignment of pregnant workers. Radiation safety program.   | Gowns, gloves, and eye protection  |
| <b>Exposure to ionizing radiation through caring for patients who have received therapeutic amounts of radionuclides</b>     | Provide private room with bathroom for patient. Precautionary covering of surfaces likely to be contaminated.  | Radiation safety program. Worker education. Minimize time spent in close proximity to patient. Proper signage. Safe work practices (including proper handling of body substance, use of disposable items where possible, proper waste disposal, cleaning procedures, | Use of gloves, protective clothing, and eye protection as determined based on hazard assessment. |

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|  |  | spill response procedures).<br>Area monitoring as required.<br>Emergency response procedures for medical emergencies.  |   |
| <b>Exposure to ionizing radiation during interventional procedures</b>                     | Workplace design to provide distance between worker and source. Appropriate shielding materials (permanent where possible). Immobilizing devices to restrain/position patients. Audible signals on machines when exposure is ended. Interlock systems. | Radiation safety program. Worker education. Safe work procedures to reduce exposure time (procedures requiring fewer workers in area, use fast film speed and short exposure times, etc.). Scheduling. Radiation safety program. Exposure monitoring program   | Lead gloves, aprons, etc. as required.  |
| <b>Exposure to laser beams during laser surgical procedures (usually class 4)</b>          | Ensure area has no reflective surfaces. Fail-safe systems. Lock/key access for activation, interlock systems   | Radiation safety program. Worker education. Safe work procedures (including placing laser in standby mode when not in use, single-operator activation, activate laser only when tip is under direct observation by surgeon, etc.). Restricted work area. Laser safety program.   | Gloves, gowns, and eye protection based on specific parameters of laser in use (wavelength, pulse versus continuous, wattage, laser class/type) |
| <b>Exposure to microwave or radiofrequency radiation when performing diathermy surgery</b> | Proper maintenance of equipment. Visible/audible sign that the equipment is operating. Workplace design to prevent scatter of radiation. Non-conductive heating table.   | Worker education. Safe work procedures (including turning on power only after electrodes are in place, careful placement of electrodes to minimize stray radiation, operator maintaining proper distance from electrodes and cables, etc.). Treatment provided by authorized personnel only. Removal of any flammable materials from vicinity. |   |
| <b>Exposure to microwave radiation through the use of</b>                                  | Ensure proper  | Worker education. Safe work  | Heat resistant gloves for   |

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| <b>microwave ovens</b>   | maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open. | procedures that incorporate ensuring the worker uses distance as a control measure.   | removing items from the oven.                              |
| <b>Falling hazards associated with slips, trips and falls</b>                  | Install slip resistant flooring. Design stairwells according to accepted safety standards. Ensure adequate lighting.                                    | Perform regular maintenance on flooring, stairwells, hallways, handrails, etc. Inspect ladders prior to use. Worker education. Implement a spill cleanup program that includes prompt spill cleanup, use of warning signs, etc. Maintain good housekeeping practices and minimize clutter and tripping hazards. | Appropriate footwear with gripping soles and good support. |
| <b>Cuts from sharp instruments, including medical instruments</b>              | Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage of sharps.                                 | Worker education. Safe work procedures.   |  |
| <b>Cuts from passing instruments in operating theatres</b>                     | Replace sharps with Safety Engineered Medical Devices. Retractors. Transfer trays and magnetic drapes.  | Worker education. No touch technique for passing instruments. Neutral zone. Other safe work procedures, including communication, proper handling of instruments, etc. Safe disposal of sharps.  |  |
| <b>Cuts from sharp instruments, including medical instruments and scissors</b> | Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage of sharps.                                 | Worker education. Safe work procedures.   |  |
| <b>Exposure to cryogenic agents in cryosurgical</b>                            | Substitution (CO <sub>2</sub> instead   | Worker education. Safe work   | Face shields, goggles,                                     |

|   |  |   |  |
|---|--|---|--|
| <b>procedures</b>   | of N <sub>2</sub> O) where possible. Proper storage of containers, including exhaust ventilation, scavenging systems, storage away from moisture, ignition sources and flammable materials. Use of proper lifting and transfer devices (hand truck or cart). Containers with pressure relief valves. Equipment maintenance. Restricted access. | practices. Spill and exposure emergency response equipment and procedures. Oxygen depletion monitoring (depending upon hazard assessment).          | insulated gloves, and protective clothing as required based on hazard assessment. Earplugs if venting gases. |
| <b>Burns from handling hot equipment or materials</b>   | Warning systems when surfaces are hot. Interlock systems that prevent opening of equipment when hot surface or steam may be present.   | Worker education. Safe work procedures.   | Insulated gloves.  |
| <b>Burns from handling recently heat-sterilized equipment</b>                                       | Work process design to manage equipment turnover.  | Safe work procedures. Rotation of supplies.   | Heat-resistant gloves.   |
| <b>Fire, projectiles, or physical injury if Oxygen gas cylinders damaged, dropped or mishandled</b> | Install protective valve caps when cylinder is not in use if the cylinder is equipped with a means of attaching caps. Secure and restrain cylinders.   | Safe work procedures that includes use, care, maintenance, storage and transport. Worker training.  |  |
| <b>Electrical hazards arising from use of electrical cords and appliances.</b>                      | Ground fault circuit interrupters when used close to water sources.  | Safe work procedures that include use of electrical cords, power bars and appliances that includes facility approval requirements. Worker training. |  |

## Notes about controls for physical hazards

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### *Engineering Controls*

#### Ergonomic hazards

One of the most commonly encountered physical hazards for medical and surgical caregivers is the use of awkward body positions as well as lifting and transferring when moving patients. Engineering controls include patient lifting devices appropriate to the required lift and for the patient, the use of ramps where possible, and ergonomically designed work areas. Hazards of manually handling residents could be reduced by a program that includes:

- Policies for risk assessment and control
- Having adequate equipment
- Having adequate staffing
- Ongoing resident handling training
- Management commitment
- Staff involvement
- Incident investigation, follow-up and communication

According to the No Unsafe Lift! Workbook,<sup>10</sup> three key risk assessments are required to determine what procedures or equipment should be used for patient handling. These are a workplace assessment, a patient assessment and a task assessment. For workplaces, key considerations include:

- The staff to patient ratio
- Types of patients
- Special needs patients
- Equipment available and accessible
- The existence of patient care plans that include handling requirements
- Languages required for effective communication

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<sup>10</sup> No Unsafe Lift! Workbook, Alberta Employment and Immigration. Available at [http://employment.alberta.ca/documents/WHS/WHS-PUB\\_nounsafelift\\_workbook.pdf](http://employment.alberta.ca/documents/WHS/WHS-PUB_nounsafelift_workbook.pdf)

- Workload issues
- Workers wearing appropriate clothing and footwear
- Communication protocols for patient status information
- Patient lifting and transfer plans
- Trained staff
- Preventive and reparative maintenance programs for equipment in place
- Sufficient space to perform tasks, including use of mechanical lifts
- Walkways free of clutter
- Floor surfaces in good order
- Stable, suitable furniture
- Electric, adjustable beds
- Adequate lighting for tasks

For patients, key factors include;

- Capability to bear weight, move normally, tolerate basic tasks
- Patient conditions that may impact risk such as history of falls, impaired movement, pain, loss of sensation, skin issues, communication issues, medical equipment used, surgical conditions, sensory deficiencies, mental state (confusion), aggression, etc.
- Types and frequency of transfers, lifts, repositioning required

For a task assessment, consideration should be given to whether the task needs to be done, as well as the risks associated with the tasks. These may include

- Static positions that may be required
- Duration of task
- Awkward postures for caregivers
- Task requiring extended reach
- Restrictions posed by protective equipment
- Inflexibility of time for task

Other engineering controls related to manual materials handling include:

- Eliminate the need to push/pull/carry
  - Automate pushing, pulling and carrying tasks (examples include using mechanical rollers/conveyors and gravity feed systems).
  - Use mechanical aids such as carts, dollies, or lift trucks or pallet jacks.
- Avoid carrying wide or tall (bulky) loads; if possible redesign the load
- Provide handles to objects to be lifted.
- Ensure that friction between the floor and the cart wheels is low.
- Minimize the distances over which objects are to be pushed, pulled, or carried (change the layout of the workplace if necessary).
- Utilize carts or wheeled devices designed for the specific application. Consider handle design, handle location, wheel construction, design and purpose (e.g. steering versus tracking).

### Radiation

Shielding is a critical engineering control for controlling exposure to external ionizing radiation hazards. It relies on providing a specific barrier material that absorbs, stops or attenuates the radiation. The use of shielding requires a careful consideration of the type of radiation, the required thickness of the shielding material, the location of the workers, and the potential for leakage or scatter. For medical and surgical caregivers who may be exposed to radioisotopes used in medical treatment, it is important to cover surfaces with material that may be discarded properly once contaminated.

Other engineering controls include design considerations, interlock systems and equipment selection and maintenance. For both ionizing and non-ionizing radiation, design considerations are important as engineering controls to prevent exposures. For ionizing radiation, permanent shielding should be provided in areas where there is frequent need for shielding. Mazes and other traffic area designs are used to reduce exposure by providing barriers and reducing traffic. The placement of equipment can greatly reduce awkward movement for workers.

For lasers, engineering controls include ensuring the area has no reflective surfaces, the provision of fail-safe system and lock/key access for activation as well as interlock systems. Interlock systems are mechanical systems that prevent the operation of the equipment or some facet of the equipment until an action or other system is engaged or completed. Interlock systems are used extensively in radiation equipment to ensure that the equipment cannot be accidentally activated. Examples of interlock systems include the system that prevents the operation of a biological safety cabinet light when the UV lamp is turned on, the turning off of microwave generation in a microwave oven when the door is opened, and a key control to activate the master switch on a laser.

The choice and the maintenance of equipment are critical engineering controls. Equipment design that includes advanced safety features (such as audible/visible signals when the equipment is operating, interlock or key/lock systems, permanent shielding, etc.) should be considered whenever possible. Equipment calibration and maintenance will ensure the equipment performs optimally and reduces the potential for accidental worker exposure.

### Trips, Slips and falls

In order to prevent slips, trips and falls, adequate lighting should be available. Cords and other tripping hazards should not be in the path of traffic. Non-slip flooring should be provided. The following are common engineering controls used to reduce the risk of slips, trips and falls in patient care areas:

- Designing patient care areas and equipment layout to minimize cords and to accommodate equipment without creating tripping hazards.
- Designing patient care areas with adequate space to accommodate portable equipment without creating tripping hazards.
- Providing adequate storage space to minimize the storage of equipment in hallways.
- Keeping hallways clear of obstructions.
- Using cord covers over electrical cords, as necessary.
- Ensure stairways in new facilities are designed safely (see National Building Code and local jurisdictional building codes).
- Utilize non-slippery surfaces on the whole steps or at least on the leading edges.
- Perform regular maintenance to keep stairs in good repair. Ensure nothing is sticking out of surfaces on the stairs, handrails or banisters (e.g. nails or splinters).
- Maintain lighting levels.
- Use angular lighting and colour contrast to improve depth perception.

### Cuts

The most effective controls to reduce cuts are engineering controls. Common engineering controls include

- Substitution of medical sharps with safety engineered medical devices (SEMDs)
- Substitution of a sharp instrument with a less sharp alternative (e.g. engineered sharps injury prevention devices)
- Safety cutters as bag and box openers
- Proper storage and disposal of sharps
- Transfer trays and magnetic drapes in operating rooms



### Temperature Extremes

Cryogenic liquids are liquefied gases that are maintained in a liquid state by keeping them at very low temperatures and maintaining them under pressure. Cryogenic agents are used for a number of procedures in healthcare, including removal of tissue (cryosurgery) and freezing of cells for storage.

Major hazards associated with cryogenic agents are the rapid expansion of the gases resulting in increased concentration of the gas in surrounding air, and burns from contact with the cryogenic agent or material or equipment that contains it. The increased concentration of gases may cause asphyxiation if the gases displace oxygen or the gases themselves may be toxic. In addition, under some circumstances, cryogenic agents can be flammable or can be explosive when expanding rapidly.

Exposure of tissues to cryogenic materials or frozen surfaces can cause severe burns (frostbite) or cause tissue to become stuck to metal that is cooled by cryogenic agents.

Substitution with a less hazardous freezing agent would be the engineering control of choice if possible. Other engineering controls include local exhaust ventilation where cryogens are stored and used (the type depending upon the hazard assessment), effective general ventilation to dilute any vapours, design of storage area to ensure proper segregation of chemicals, use of proper and well-maintained storage vessels, restricted access to storage areas, proper calibration and maintenance of equipment, pressure release valves, and alarm systems.

Heat-related burns may occur during flash sterilization or through contact with hot surfaces, fire, or steam. Engineering controls are aimed at reducing contact with hot surfaces or steam. These include effective workplace design (that limits traffic in hot areas, reduces proximity to hot surfaces, provides sufficient space to work and move around hot equipment, etc.), shielding, process changes, local exhaust ventilation for the removal of steam, interlock systems that prevent opening autoclaves or sterilizers until a cooler temperature is reached, mechanical devices (tongs, etc.) for manipulating hot items, temperature and pressure relief valves, and reducing hot water temperatures.

### Pressure

Compressed gas cylinders are designed to safely hold their contents during regular use and the demands expected to be placed on them. Regulators, fittings and delivery systems must likewise meet manufacturers' requirements. Oxygen cylinders should be stored away from any heat sources or combustible material; they should be stored upright and not be able to move freely or fall.

Protective valve caps are an engineering control to protect the valve head from damage when the cylinder is not in use. If the cylinder has a valve cap, the cap should always be placed on cylinders when the cylinder is not expected to be used for a period of time, such as for a work shift. All cylinders must be restrained from tipping by means of racks, chains, strap or other suitable means.

### Electrical Hazards

Insulation protects workers from contact with electricity. All equipment, wiring and cords must be maintained and used in a manner that keeps electrical insulation intact.

Electric appliances and equipment are protected from overloading by means of electric overloading devices such as fuses or circuit breakers. Although these devices will stop the flow of current when too much current flows through them, they are intended to protect equipment but not workers. All overloading devices must be of sufficient ratings. Replacing fuses or circuit breakers with overloading devices that trip at a higher current than specified is a dangerous practice as is replacing overloading devices with a conductor. Ground fault circuit interrupters (GFCIs) are safety devices that will interrupt the flow of current by monitoring the flow of current to and from the device. GFCIs are important engineering controls that should be used in wet environments and to power tools and equipment outdoors.

Another important engineering control is grounding. Grounding of electrical equipment refers to creating an electrical path to earth (ground). Grounding provides some protection to equipment operators if there is a fault in the equipment or insulation that energizes the equipment housing; electricity would flow to ground rather than through the worker. Grounding for equipment that is plugged into electrical receptacles can be identified by the third prong on the electrical plug. Similarly electrical cords commonly have a third prong on the plug end. The third prong that facilitates grounding must not be removed or defeated. The housings of all equipment should be suitably grounded. Some electrical cords for tools or other equipment do not have a third grounding prong. This equipment is double insulated, meaning that it has been designed with additional insulating considerations to prevent the housing of the device from becoming energized. Such a device will be labelled with the term “double insulated” or with a symbol comprised of a square box within another square box.

## *Administrative Controls*

### Ergonomic hazards

Controls that focus on how work is performed and organized are administrative controls. Administrative controls include policies, procedures, work practices, rules, training, and work scheduling, including:

- Ensure all aspects of a No Unsafe Lift! Program<sup>11</sup> are implemented.
- Establish ergonomic purchasing standards for tools and equipment, including patient lifting devices and vehicles.
- Provide procedures for patient assessments.
- Conduct user trials to test new equipment and tools with input from workers.
- Maintain equipment, vehicles and tools to optimize their operation.
- Provide training programs to educate workers regarding biomechanical risk factors, signs and symptoms and safe work practices (including proper lifting methods and proper use of lifting devices).
- Provide self assessment tools to identify and control biomechanical hazards.
- Optimize work shift scheduling to minimize extended work hours and overtime.
- Design break schedules to reduce biomechanical hazards.
- Encourage monitoring and early reporting of the signs and symptoms of musculoskeletal injuries (MSIs).

### Radiation

Administrative controls include policies and procedures and on-going assessment of possible exposures to radiation. The policies and procedures are designed to ensure that workers are informed about the hazards of both ionizing and non-ionizing radiation and are trained in the safe work procedures necessary to prevent exposure. Some administrative controls include having a radiation safety program, a laser safety program, safe work practices, monitoring exposures, and proper disposal practices. Minimize contact with body substances from patients receiving treatment with radionuclides.

### Trips, Slips and falls

Administrative controls to prevent slips, trips and falls include:

- Education of workers and enforcement of the use of proper footwear

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<sup>11</sup> No Unsafe Lift! Workbook, Alberta Employment and Immigration. Available at [http://employment.alberta.ca/documents/WHS/WHS-PUB\\_nounsafelift\\_workbook.pdf](http://employment.alberta.ca/documents/WHS/WHS-PUB_nounsafelift_workbook.pdf)

- Timely clean-up of any spills
- Eliminate the use of extension cords that may pose tripping hazards
- Keep walkways free of clutter

### Cuts

Administrative controls widely used to reduce the potential for cuts include

- Worker education
- Safe work procedures (including no-touch instrument passing in operating theatres)
- Keeping sharp edges away from the body
- Counting and controlling access to cutlery and tools in mental health facilities
- Use of tools correctly
- Engaging all machine guards
- Choice of appropriate tool
- Restricted access to work areas
- Signs and warnings in hazardous areas, and
- Safe disposal of all sharps, including broken glass.

### Temperature Extremes

For cryogenic hazards, administrative controls include worker education about the nature of the hazard and how to work safely with cryogenic agents, safe work practices (including insertion of materials so that boiling and splashing can be avoided, avoiding touching the skin with any part of the equipment, purchasing appropriate vials for freezing and thawing, etc.), and emergency response procedures for spills or exposures.

To reduce the risk of burns, administrative controls include worker education, established safe work practices, assessment of work area to identify potential sources of burns, and equipment maintenance programs.

### Pressure

Compressed gas cylinders must be handled, maintained and stored carefully to prevent cylinders from falling or a gas release. Proper transportation of cylinders must also be considered whether it be by vehicle or within a work area by use of a hand cart or other means. A safe work procedure should be developed for the use, transport, storage and maintenance of compressed gas cylinders in the workplace. Some key compressed gas safe work practices are detailed below:

### **What are basic safe practices when working with compressed gases?<sup>12</sup>**

- Read the MSDSs and labels for all of the materials you work with.
- Know all of the hazards (fire/explosion, health, chemical reactivity, corrosivity, pressure) of the materials you work with.
- Know which of the materials you work with are compressed gases and check the label, not the cylinder colour, to identify the gas.
- Store compressed gas cylinders in cool, dry, well-ventilated areas, away from incompatible materials and ignition sources. Ensure that the storage temperature does not exceed 52°C (125°F).
- Store, handle and use compressed gas cylinders securely fastened in place in the upright position. Never roll, drag, or drop cylinders or permit them to strike each other.
- Move cylinders in handcarts or other devices designed for moving cylinders.
- Leave the cylinder valve protection cap in place until the cylinder is secured and ready for use.
- Discharge compressed gases safely using devices, such as pressure regulators, approved for the particular gas.
- Never force connections or use homemade adaptors.
- Ensure that equipment is compatible with cylinder pressure and contents.
- Carefully check all cylinder-to-equipment connections before use and periodically during use, to be sure they are tight, clean, in good condition and not leaking.
- Carefully open all valves, slowly, pointed away from you and others, using the proper tools.
- Close all valves when cylinders are not in use.
- Never tamper with safety devices in cylinders, valves or equipment.
- Do not allow flames to contact cylinders and do not strike an electric arc on cylinders.
- Always use cylinders in cool well-ventilated areas.
- Handle "empty" cylinders safely: leave a slight positive pressure in them, close cylinder valves, disassemble equipment properly, replace cylinder valve protection caps, mark cylinders "empty" and store them separately from full cylinders.
- Wear the proper personal protective equipment for each of the jobs you do.
- Know how to handle emergencies such as fires, leaks or personal injury.
- Follow the health and safety rules that apply to your job.

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<sup>12</sup> CCOHS; *OSH Answers – How Do I Work Safely with Compressed Gasses?*; July 8, 2008;  
[http://www.ccohs.ca/oshanswers/prevention/comp\\_gas.html](http://www.ccohs.ca/oshanswers/prevention/comp_gas.html)

### Electrical Hazards

A major component of an electrical safety program is worker training. Extension cords are used in many applications for temporarily supplying power. Considerations to follow when using extension cords include:

- Protect cords from damage; do not allow vehicles to drive over cords.
- Never keep an extension cord plugged in when it is not in use.
- Do not use a damaged extension cord.
- Extension cords and most appliances have polarized plugs (one blade wider than the other). These plugs are designed to prevent electric shock by properly aligning circuit conductors. Never file or cut the plug blades or grounding pin of an extension cord.
- Do not plug one extension cord into another. Use a single cord of sufficient length.

Hazard assessments should guide the development of work procedures to assess and control electrical hazards.

### ***Personal Protective Equipment Controls***

#### Ergonomic hazards

The most important personal protective equipment to control ergonomic hazards is appropriate footwear with gripping soles and good support.

#### Radiation

Depending upon the nature of the radiation and the specific tasks the worker is performing, a range of PPE may be used as additional controls (to engineering and administrative controls) to reduce exposures. Examples include protective eyewear used when working with lasers, UV, infrared or ionizing radiation that is specifically made to reduce exposure to each type of radiation.

Protective clothing is also used when working with various forms of radiation. For ionizing radiation, protective clothing (commonly called lead aprons) includes shielding materials. All ionizing radiation protective clothing must be uniquely identified and inspected annually with an x-ray machine for any cracks or holes in the shielding material. These inspections results must be recorded and saved. Clothing also protects against exposure to UV rays. Gloves protect workers from contamination with radioactive material and must be worn when there is the potential for contamination.

### *Trips, Slips and falls*

The use of appropriate footwear by medical and surgical caregivers is essential to prevent trips, slips and falls. Workers should be required to wear flat shoes with non-slip soles that offer good support. (To prevent chemical exposure in the event of a spill, footwear should cover the entire foot and be of non-porous material.)

### *Cuts*

Eye protection is important if there is any possibility that fragments of glass or other sharps may enter the eyes, and footwear must protect the wearer from accidental exposure to sharps. Gloves are usually required as PPE to protect workers from cuts. The selection of gloves depends on the nature of task. Cut-resistant gloves are available that are made from a variety of materials including Kevlar, Dyneema, HexArmor, stainless steel and wire mesh.

### *Temperature Extremes*

PPE to protect workers from cryogenic hazards include non-porous and non-woven protective clothing, full foot protection, insulated gloves, safety glasses or a face shield (based on nature of the task). PPE is often used to prevent burns. Insulated gloves, protective clothing, foot protection, and eye/face protection should be chosen based on the hazard assessment.

## Psychological Hazards and Controls

Each medical or surgical division should systematically conduct hazard assessments for tasks performed by medical and surgical caregivers and identify if and where the potential exists for psychological hazards. In this section, examples are provided of psychological hazards that may be encountered by medical and surgical caregivers, and possible control measures will be suggested. This information will be useful for inclusion into hazard assessments. Please note, this is not designed to be an exhaustive treatment of the subject, but is rather an overview summarizing the some of the reported psychological hazards in healthcare settings.

### Note:

The following chart provides basic information about control strategies for commonly occurring psychological hazards. The selection of controls should be based on a risk assessment of the tasks and environment. Worker tolerance to stressors varies considerably. Most controls listed here relate to organizational controls, with some mention of personal controls that may be useful in controlling risk. Worker education and good communication processes are critical administrative controls. All legislation related to the assessment of hazards, selection and use of controls should be followed.

| Potential Psychological Hazards or Effects of Workplace Stressors | Summary of Major Control Strategies                  |  |   |
|---|--|--|---|
|   | Engineering  | Administrative   | Personal  |
| <b>Abuse by clients or members of the public</b>                  | Alarm systems and panic buttons. Video surveillance. | Management policies and procedures related to no tolerance of violence or abuse. Worker education in violence awareness, avoidance and de-escalation procedures. Liaison and response protocols with local police. Working alone policies. Reporting procedures for incidents and near misses. | Ability to request support. Use of counselling services.              |
| <b>Abuse by co-workers</b>  | Alarm systems and panic buttons. Video surveillance. | Management policies and procedures related to no tolerance of violence or abuse. Worker education in violence awareness, avoidance and de-   | Assertiveness training. Use of mediation and/or counselling services. |



|  |   |  |   |
|--|---|--|---|
|  |   | escalation procedures. Working alone policies. Reporting and investigation procedures for incidents and near misses.   |   |
| <b>Hazards related to working alone</b> <ul style="list-style-type: none"> <li>• <b>Threat of violence</b></li> <li>• <b>Medical emergencies when alone</b></li> </ul> | Communication devices.<br>Vehicle design considerations.<br>Panic alarms. Bright lighting.<br>Surveillance cameras. | Scheduling to avoid having workers work alone. Worker training. Working alone policies.  |   |
| <b>Stress related to critical incidents</b>  |   | Training to increase awareness of signs and symptoms of critical incident stress. Critical incident stress team to respond to incidents. Communication and call procedures to mobilize team. Defusings and debriefings as appropriate.   | Development of support systems to assist in dealing with stress. Use of counselling services.   |
| <b>“Technostress” related to the introduction of new technology</b>  | Design of instruments or equipment with user-friendly features.   | Selection procedures to ensure user-friendly technology choices. Provision of sufficient training for workers. Worker participation in selection and implementation of new technology. Provision of problem solving resources and support workers. Back-up plans in the event of failures. Change management strategy for introduction of new technology. Realistic expectations regarding use of communication technology. Limit use of technological monitoring of worker productivity. Setting and communication of priorities. | Self-education concerning new technologies. Time management strategies. Open communication about stress related to change. Healthy lifestyles. Setting realistic goals. Limiting the need to multi-task. Technology “time outs”. E - vacations. |
| <b>Substance abuse as a response to excessive workplace stressors</b>  |   | Worker involvement in substance abuse policy and procedures development. Worker education about substance abuse. Training workers and supervisors to recognize the signs of substance abuse. Procedures to limit individual access to narcotics. . Provision of counselling services and return to work plans.   | Increase awareness of substance abuse signs and symptoms. Communication with counsellors. Report to family physician. Participate in treatment programs and return to work programs.  |
| <b>Depression, anxiety, sleep</b>  |   | Worker education about the signs and   | Programs to maintain or build   |

|   |   |   |   |
|---|---|---|---|
| <b>disorders, other mental illness as a response to excessive workplace stressors</b> |   | <p>symptoms of depression, anxiety, sleep disorders, other mental illness. Elimination of workplace risk factors for depression, anxiety, sleep disorders, other mental illness. Provision of support services and programs. Benefit plans provision. Effective return to work programs.</p>  | <p>resilience or coping skills. Development of support system. Communication with family physician.</p>   |
| <b>Hazards related to impacts of aging on workers</b>                                 | <p>Mechanical devices and power equipment for lifting / moving. Storing objects at appropriate heights, packing in smaller quantities or containers. Supportive, adjustable seating and workstations. Cell phones and pagers that incorporate vibration. Proper lighting.</p> | <p>Management policies and procedures that ensure no age discrimination. Proactive policies to accommodate aging workers. Training opportunities for aging workers. Education for all workers on intergenerational communication. Aging workers as trainers/mentors. Flexible work arrangement. Job redesign to accommodate aging workers.</p>  | <p>Healthy lifestyle. Use of client and material handling equipment. Adequate sleep. Awareness of potential side effects of medication.</p>   |
| <b>Hazards related to shiftwork, excessive workload and hours of work</b>             | <p>Appropriate lighting levels. Lighting levels that are adjustable by workers. Appropriate thermal environment.</p>  | <p>Management policies and procedures to address working hours and shift design. Worker involved in design of shift schedule. Limit hours of work and overtime. Shifts designed so workers get enough rest between shifts. Split shifts are avoided, if possible. Train workers and management in fatigue and shift work issues. Work shift schedules designed to minimize fatigue (e.g. maximum number of consecutive night shifts, forward rotation, etc.). Quality breaks are in place. Policies to encourage the reporting of concerns associated with fatigue. Thorough investigation of incidents and near misses with fatigue as a possible cause.</p> | <p>Appropriate sleep schedule and sleep environment. Strategies in place to promote sleep. Diet adjusted to accommodate shift schedule. Healthy lifestyle. Physical exercise. Safe plan for commute to work. Plan for family and friends. Use of stimulants and sedatives are minimized.</p> <p>Alertness strategies are utilized (e.g. bright lighting levels, regular short breaks, communication with co-workers, etc.).</p> |
| <b>Stress related to work-life conflict</b>   |   | <p>Management policies and procedures that support work-life balance (e.g. voluntary reduced hours, voluntary part-time work, phased in retirement, telecommuting, job sharing, paid and</p>  | <p>Time log used to track time. Work-life balance programs are utilized. Work activities are isolated from home time. Time is effectively managed.</p>  |

|  |   |   |   |
|--|---|---|---|
|  |   | <p>unpaid leaves, dependent care initiatives, etc.). Work designed to address workload and work demands issues. Reliance on paid and unpaid overtime is reduced. Supportive management culture. Work-life balance policies are communicated to workers. The use and impact of work-life balance policies is measured.</p>   | <p>Days off are protected. Appropriate sleep habits. Social support system is in place.</p> |
| <p><b>Exposure to nuisance or irritating noise levels that may induce stress</b></p> | <p>Any engineering controls required to abate noise to allowable levels, if over PEL. Sound absorber panels. Personal communication devices rather than overhead pagers. Maintenance and repair of facility equipment, including the ventilation system. Lubrication of equipment with moving parts. Design considerations related to noise reduction in new/renovated facilities. Padded chart holders and pneumatic tube systems. Sound-masking technology.</p> | <p>Lower rings on telephones. Encourage use of soft-soled shoes. Worker education on noise levels created by various activities. Posted reminders to reduce noise. Purchasing decisions that take into account noise levels of equipment. Location of noisy equipment to more isolated areas. Work organization at nursing stations to reduce noise.</p>  |   |
| <p><b>Exposure to poor indoor air quality that may induce stress</b></p>             | <p>Proper ventilation system design. Ventilation system maintenance activities. Isolation/segregation of work processes that may create contaminants.</p>   | <p>Contractor requirements to reduce air contamination. Selection of low-pollutant cleaning chemicals. Cleaning schedules. Infection prevention and controls standards. Rules regarding the use of personal appliances that may impact HVAC operations. Procedures to report and investigate indoor air quality complaints. Worker involvement in indoor air quality investigation. Communication to enable frank and timely discussion of IAQ issues and what is being done to resolve them.</p> |   |

## Notes about controls for psychological hazards

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Potential psychological hazards and controls vary greatly in jobs, locations and organizations and are only briefly discussed here. Personal factors impact how stressors are viewed and addressed. A comprehensive discussion of causes and impacts of psychological stressors on workers and on the organization can be found in Best Practices for the Assessments and Control of Psychological Hazards – Vol. 5. Included in the discussion are the topics of environmental factors such as noise and indoor air quality and their impacts on personal health, as well as outcomes of workplace stress that may impact personal health such as substance abuse, depression, anxiety, sleep disorders and other mental illness, and age-related factors.

### Program elements for preventing or controlling violence and abuse towards workers in the workplace

Because the scope of abuse of workers is broad, with a wide range of potential internal and external perpetrators and a myriad of individual considerations, prevention of abuse of workers is multi-faceted. This list of prevention procedures and control techniques is not all-inclusive, but rather a sample of the complexities that should be considered in a program for medical and surgical caregivers:

- Development, communication and enforcement of policies that indicate no tolerance for any form of violence, harassment, or abuse including bullying. Awareness sessions for all workers on abuse and violence in the workplace, reporting procedures and controls.
- Staff identification to reduce unauthorized access to areas – this includes a requirement of all workers to wear identification badges. It is suggested that information that is not necessary not be shown on the front to the badge to reduce risk to workers.
- Client guidelines and signage to emphasize that abuse will not be tolerated – this may include the preparation and dissemination of client information guidelines, in which client behaviour is discussed, the commitment to no tolerance for abuse against workers and the encouragement of mutual respect are covered.
- Working alone guidelines and communications protocols. Working alone guidelines are required by Alberta occupational health and safety legislation (OHS Code, Part 28), and must include a written hazard assessment as well as communication protocols for workers who must work alone.
- Alarm systems and emergency communication devices (panic buttons, etc.). Identification of workers or locations that should be provided with alarm systems and panic buttons should occur. Once any alarm systems are installed or provided, all workers should be trained on how to use them and how to respond to alarms.
- Identification and correction of high risk facility issues (e.g., isolated areas, parking lots, low lighting, no escape routes, etc.). There are many risk factors posed by the design of the facility. The medical or surgical division should identify risk factors

and work to reduce the risk in the areas. A checklist would be useful for departments to help identify facility issues contributing to worker risk.

- Training programs that include non-violent crisis intervention and assault management techniques.

### Working alone

Working alone is addressed in the Alberta OHS Code 2009.

#### **Controls required**

Employers must, for any worker working alone, provide an effective communication system consisting of

- radio communication,
- and land line or cellular telephone communication, or some other effective means of electronic communication that includes regular contact by the employer or designate at intervals appropriate to the nature of the hazard associated with the worker's work.

If effective electronic communication is not practicable at the work site, the employer must ensure that

- the employer or designate visits the worker, or
- the worker contacts the employer or designate at intervals appropriate to the nature of the hazard associated with the worker's work.

Alberta OHS Code 2009, Part 28

### Work-Life balance, including reduction of excessive workloads

An employer should strive to develop policies and programs that support work-life balance. The following is a list of general work-life balance policies and programs to consider:

1. Flexible time arrangements including alternative work schedules, compressed work week, voluntary reduced hours / part-time work and phased in retirement
2. Flexible work locations through the use of technology such as telecommuting and satellite offices
3. Flexible job design through job redesign, job sharing
4. Wellness programs
5. Flexible benefits including paid and unpaid leaves for maternity, parental care giving, educational and sabbatical leaves
6. Employer sponsored childcare and eldercare practice and referral services

A work-life conflict issue recognized in healthcare is often brought on by workload and work demands. Some strategies to reduce the impact of increased workloads and work demands include the following:

- Identify methods to reduce worker workloads. According to research, special attention is required for managers and professionals.
- Track the costs associated with understaffing and overwork (paid and unpaid overtime, increased turnover, employee assistance program use, increased absenteeism).
- Strive to reduce the amount of time workers spend in job-related travel.
- Reduce reliance on paid and unpaid overtime.
- Consider a “time in lieu” system to compensate for overtime.
- Develop norms regarding the use of technology (e.g. cell phones, PDA, laptops, email) outside of work time.
- Allow workers to say “no” to overtime without repercussions.
- Provide a limited number of days of paid leave per year for caregiver responsibilities (childcare and eldercare) and personal problems.
- Measure the use of work-life practices (e.g. job sharing, compressed work week, etc.) and reward sections of the organization with high usage. Investigate sections where usage is low.
- Increase supportive management. Specifically, organizations should increase the extent to which managers are effective at planning the work to be done, make themselves available to answer worker questions, set clear expectations, listen to worker concerns and give recognition for a job well done.

### *Technostress (stress resulting from the introduction of new technologies)*

The primary controls an organization employs to reduce the potential of technostress are administrative controls. While major engineering control opportunities exist in the design and development of technology to make it easier to use, an employer’s choice of technology is an administrative control.

Administrative controls an organization can use to reduce the risk of technostress include:

- Selection of technology that is designed to be easy for the user
- Worker participation in selection, trial and implementation of technology and the provision of feedback as to its use
- Sufficient worker training to ensure that workers feel confident and competent to use the technology
- Provision of problem-solving resources and support to workers

- Back-up plans in the event of technology failure
- Influential, credible supporter for the introduction of the new technology (executive support)
- Use of a change management strategy for organization-wide technology change
- Setting of realistic expectations for the use of communication technology
- Reduced use of technological monitoring of worker productivity
- Setting and communicating priorities to relieve stress in multi-tasking
- Updates of hazard assessments each time new technology is introduced.

Personal controls for reducing the risk of technostress include:

- Self-education concerning new technologies
- Open communication about stress related to change
- Time management
- Setting priorities
- Healthy lifestyle including good nutrition, exercise and getting enough sleep
- Setting realistic goals
- Limit the need to multi-task
- Technology “time-outs” (avoiding being “plugged in” continually)
- Relaxation, meditation and taking vacations (especially e-vacations)

### Shiftwork

The following guidelines will assist in reducing the psychological impacts of shift work.

#### **Good Practice Guideline for Shift Work Schedule Design<sup>13</sup>**

- Plan a workload that is appropriate to the length and timing of the shift.
- Strive to schedule a variety of tasks to be completed during the shift to allow workers some choice about the order they need to be done in.

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<sup>13</sup> Adapted from Government of the U.K; Health and Safety Executive; Managing shift work HSG256; 2006; [www.hse.gov.uk/pubns/priced/hsg256.pdf](http://www.hse.gov.uk/pubns/priced/hsg256.pdf)

- Avoid scheduling demanding, dangerous, safety-critical or monotonous tasks during the night shift, particularly during the early morning hours when alertness is at its lowest.
- Engage workers in the design and planning of shift schedules.
- Avoid scheduling workers on permanent night shifts.
- When possible, offer workers a choice between permanent and rotating shifts.
- Use a forward-rotating schedule for rotating shifts, when possible.
- Avoid early morning shift starts before 7 AM, if possible.
- Arrange shift start/ end times to correspond to public transportation or consider providing transport for workers on particular shifts.
- Limit shifts to a maximum of 12 hours (including overtime) and consider the needs of vulnerable workers.
- Limit night shift to 8 hours for work that is demanding, dangerous, safety critical or monotonous.
- Avoid split shifts unless absolutely necessary.
- Encourage and promote the benefit of regular breaks away from the workstation.
- Where possible, allow workers some discretion over the timing of breaks but discourage workers from saving up break time for the end of the workday.
- In general, limit consecutive working days to a maximum of 5-7 days.
- For long work shifts (>8 hours), for night shifts and for shifts with early morning starts, consider limiting consecutive shifts to 2-3 days.
- Design shift schedules to ensure adequate rest time between successive shifts.
- When switching from day to night shifts (or vice versa), allow workers a minimum of 2 nights' full sleep.
- Build regular free weekends into the shift schedule.

For a more detailed discussion of controls to prevent or reduce psychological hazards, please consult Best Practices for the Assessments and Control of Psychological Hazards – Vol. 5.



## APPENDIX 1 - OHS-related Competencies for medical and surgical caregivers

### **OHS – related Competencies for Registered Nurses**

The College and Association of Registered Nurses of Alberta provides these Entry to Practice Competencies related to OHS for Registered Nurses. For more details, please see <http://www.nurses.ab.ca/Carna-Admin/Uploads/Entry-to-Practice%20Competencies.pdf>

| <b>Competency</b>   |
|---|
| Professional Accountability and Responsibility<br>11. Uses basic conflict resolution strategies in which situations of conflict are transformed into healthier interpersonal interactions.  |
| 13. Protects clients through recognizing and reporting unsafe practices when client or staff safety and well-being are potentially or actually compromised.   |
| 16. Identifies, reports and takes action on actual and potential safety risks to clients, themselves or others.   |
| Specialized Body of Knowledge<br>23. Has a knowledge base about workplace health and safety including body mechanics, safe work practices, prevention and management of aggressive or violent behaviour.  |
| 30. Knows how and where to find evidence to ensure personal safety and safety of colleagues in the workplace.   |
| Collaborates with Clients to Develop Plans of Care<br>50. Anticipates potential staff safety concerns and initiates appropriate action.   |
| Provides Registered Nursing Care<br>71. Consistently applies safety principles, evidence-informed practices and appropriate protective devices when providing nursing care to prevent injury to clients, self and other health-care workers.                              |
| 72. Implements preventive strategies related to the safe and appropriate use and administration of medication.  |
| 73. Implements preventive and therapeutic interventions safely (e.g., positioning, managing intravenous therapies, drainage tubes, skin and wound care).  |
| Service to the Public<br>104. Uses safety measures to protect self and colleagues from injury or potentially abusive situations (e.g., aggressive clients, appropriate disposal of sharps, lifting devices, low staffing levels, increasing workload and acuity of care). |
| 106. Uses health-care resources appropriately to ensure a culture of safety (e.g., patient lifting devices, safer sharps).  |
| Professional Self-Regulation  |

115. Understands the significance of the concept of fitness to practice in the context of individual self-regulation and public protection.

The College of Licensed Practical Nurses of Alberta provides these competencies related to OHS in the Competency Profile for Licensed Practical Nurses. For more details, please consult <http://www.clpna.com/Members/ContinuingCompetencyProgram/CompetencyProfileforLPNs2ndEdition/tabid/149/Default.aspx>

| <b>Competency</b>  |
|--|
| C-1-1 Demonstrate ability to apply critical thinking and clinical judgment in response to a fire emergency.  |
| C-1-2 Demonstrate knowledge of fire safety policy, procedures, and staff responsibilities in the event of a fire in the health care setting.   |
| C-1-2 Demonstrate knowledge of fire safety policy, procedures, and staff responsibilities in the event of a fire in the health care setting.   |
| C-1-4 Demonstrate knowledge and ability to respond to a fire situation, e.g., (REACT)  |
| C-2-1 Demonstrate ability to apply critical thinking and clinical judgment in response to a disaster emergency.  |
| C-2-3 Demonstrate knowledge to initiate the appropriate response to the emergency.   |
| C-2-6 Demonstrate knowledge of policy, procedures, and staff responsibilities in the event of a disaster in the health care setting.   |
| C-2-11 Demonstrate ability to recognize that personnel directly involved in facility response may require critical incident stress debriefing.   |
| C-3-2 Demonstrate knowledge and ability to adhere to agency policy regarding a bomb threat.  |
| C-5-1 Demonstrate knowledge and ability to properly use personal protection devices while interacting and providing care to clients, visitors, and families.                                 |
| C-5-2 Demonstrate the knowledge and ability to properly remove, clean and / or dispose of contaminated personal protection devices.  |
| C-5-3 Demonstrate knowledge and ability to use protective / safety equipment   |
| C-6-1 Demonstrate knowledge and ability to demonstrate the application of the principles of standard precautions:  |
| C-8-1 Demonstrate knowledge of the facility / organization policy for disposal of sharps.  |
| C-8-3 Demonstrate knowledge and ability to use precautions in handling of sharps and follow agency protocol regarding: <ul style="list-style-type: none"><li>• disposal of needles</li></ul> |

|   |
|---|
| <ul style="list-style-type: none"> <li>• removal of needles from disposable syringes</li> <li>• removal of scalpel blades from handle.</li> </ul> |
| C-8-4 Demonstrate knowledge and ability to immediately report needlestick injury to appropriate personnel as per agency protocol.                 |
| C-9-1 Demonstrate knowledge and ability to apply Workplace Hazardous Materials Information System (WHMIS) guidelines and regulations              |
| C-10-2 Demonstrate knowledge of agency policies regarding handling of bio-medical waste.  |
| C-13-1 Demonstrate the knowledge and ability to comply with workplace policies regarding Occupational Health and Safety.                          |
| C-13-4 Demonstrate knowledge and ability to apply self protection / prevention techniques.  |
| C-13-7 Demonstrate knowledge and ability to apply the principles of non-violent crisis intervention.  |

The Alberta College of Physicians and Surgeons provides these OHS- related standards in their Standards of Practice. For more detail, please consult <http://www.cpsa.ab.ca/Resources/standardspractice.aspx>

| Competency   |
|--|
| <p>3 Collaboration in Patient Care</p> <p>(2) A physician must treat other healthcare providers with dignity and respect.</p>  |
| <p>4 Supervision of Restricted Activities</p> <p>(4) A physician may supervise a regulated healthcare professional, an unregulated worker or a student performing a restricted activity only if the physician is satisfied that:</p> <ul style="list-style-type: none"> <li>(a) it is safe and appropriate for the supervised person to perform the restricted activity on the particular patient,</li> <li>(b) the equipment and resources available to perform the restricted activity are safe and appropriate.</li> </ul>  |
| <p>32 Self Reporting to the College</p> <p>(1) A physician must report the following personal circumstances to the College at the time of registration or whenever the physician becomes aware thereafter:</p> <ul style="list-style-type: none"> <li>(a) any transmissible blood-borne infection,</li> <li>(b) serious health issues that impairs the physician's ability to care safely for a patient including, but not limited to: <ul style="list-style-type: none"> <li>(i) substance or chemical abuse or dependency, and</li> <li>(ii) medical conditions that impair the physician's judgment or cognition</li> </ul> </li> </ul> |

## APPENDIX 2 - Additional Resources

The following are useful references and links to relevant resource materials. For complete reference lists, please consult the Best Practice documents developed by Alberta Employment and Immigration available at

<http://www.employment.alberta.ca/SFW/6311.html>

Alberta Employment and Immigration; No Unsafe Lift! Workbook; 2008 [http://employment.alberta.ca/documents/WHS/WHS-PUB\\_nounsafelift\\_workbook.pdf](http://employment.alberta.ca/documents/WHS/WHS-PUB_nounsafelift_workbook.pdf)

Alberta Government legislation related to chemicals in the workplace may be accessed through the Government website at <http://employment.alberta.ca/SFW/307.html>

Alberta OHS Code 2009, Part 18 – Personal Protective Equipment

Alberta Workplace Health and Safety *Preventing Violence and Harassment at the Workplace*, Bulletin VAH001, 2006, retrieved from <http://www.employment.alberta.ca/documents/WHS/WHS-PUB-VAH001.pdf>

American Chemical Society – Chemical Storage Resources

[http://portal.acs.org/portal/acs/corg/content?\\_nfpb=true&\\_pageLabel=PP\\_ARTICLEMAIN&node\\_id=2231&content\\_id=WPCP\\_012310&use\\_sec=true&sec\\_url\\_var=region1&\\_uuid=dae6dbb6-9d03-4590-8995-5325374e8844](http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_ARTICLEMAIN&node_id=2231&content_id=WPCP_012310&use_sec=true&sec_url_var=region1&_uuid=dae6dbb6-9d03-4590-8995-5325374e8844)

American College of Surgeons; Statement by the American College of Surgeons – *Statement on Sharps Safety; October 2007*

[http://www.facs.org/fellows\\_info/statements/st-58.html](http://www.facs.org/fellows_info/statements/st-58.html)

BC Centre for Disease Control – A Guide for the Selection and Use of Disinfectants <http://www.mtpinnacle.com/pdfs/disinfectant-selection-guidelines.pdf>

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Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers – Safety Glasses and Face Protectors*; <http://www.ccohs.ca/oshanswers/prevention/ppe/glasses.html>

Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers- Chemical Protective Clothing – Gloves*; <http://www.ccohs.ca/oshanswers/prevention/ppe/gloves.html>

Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers: Substance Abuse in the Workplace*, Retrieved from [www.ccohs.ca/oshanswers/psychosocial/substance.html](http://www.ccohs.ca/oshanswers/psychosocial/substance.html)

Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers – How Do I Work Safely with Compressed Gasses?* Updated July 8, 2008; [http://www.ccohs.ca/oshanswers/prevention/comp\\_gas.html](http://www.ccohs.ca/oshanswers/prevention/comp_gas.html)

Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers – Electrical Safety Basic Information*; updated June 1, 2000; [http://www.ccohs.ca/oshanswers/safety\\_haz/electrical.html](http://www.ccohs.ca/oshanswers/safety_haz/electrical.html)

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Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers – OHS Legislation in Canada; Internal Responsibility System*; <http://www.ccohs.ca/oshanswers/legisl/irs.html>

Canadian Centre for Occupational Health and Safety (CCOHS), *OSH Answers – Lasers*; date last updated July 4, 2003; [http://www.ccohs.ca/oshanswers/phys\\_agents/lasers.html](http://www.ccohs.ca/oshanswers/phys_agents/lasers.html)

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## APPENDIX 3 - Learning Objectives for this Module

1. Understand the need for and the procedure for conducting hazard assessments and risk evaluations.
2. Identify significant biological hazards that may impact medical and surgical caregivers.
3. Identify significant chemical hazards that may impact medical and surgical caregivers.
4. Identify significant physical hazards that may impact medical and surgical caregivers.
5. Identify potential psychological hazards that may impact medical and surgical caregivers.
6. Identify the hierarchy of controls that should be implemented to control hazards in the workplace.
7. Identify engineering controls and describe how they work.
8. Provide examples of administrative controls.
9. Describe the important considerations when selecting personal protective equipment.
10. For each type of hazards, identify possible engineering, administrative and personal protective equipment controls.

## APPENDIX 4 - Test Your Knowledge

1. In what way can medical and surgical caregivers be exposed to biological hazards?
2. What is meant by the “hierarchy of controls”?
3. Give three examples of engineering controls.
4. Give three examples of administrative controls.
5. Give three examples of personal protective equipment.
6. What are the major physical hazards that medical and surgical caregivers may be exposed to?
7. List at least five factors that should be considered in risk assessments related to patient lifts and transfers.
8. Name the five criteria for choosing the proper gloves to use.
9. Name the six criteria for selecting appropriate eye protection.
10. What administrative controls can be put in place to reduce the risk of exposure to hazardous chemicals?



### **Test Your Knowledge - Answers**

1. Medical and surgical caregivers may be exposed to biological hazards through contact with patients, members of the public or through contaminated products or contaminated ventilation systems.
2. The hierarchy of controls refers to a preferred order of controls for implementation. The highest level is engineering controls, because these control the exposure at the source. The next level is administrative controls, which relies on worker compliance. The least effective and lowest level of control is personal protective equipment, because if the equipment fails the worker is likely to be exposed.
3. Fume hoods, biological safety cabinets, preventive maintenance of equipment, safety engineered medical devices, segregated areas, automated procedures, ergonomically designed work stations, machine guarding, etc.
4. Training, policies, safe work procedures, restricted access, appropriate staffing, purchasing diluted solutions, signage, purchasing standards, etc.
5. Protective eyewear, gloves, lab coats, respirators, etc.
6. Ergonomic, slips, trips, falls, temperature extreme, motor vehicle collisions
7. Workplace factors including:
  - The staff to patient ratio
  - Types of patients
  - Special needs patients
  - Equipment available and accessible
  - The existence of patient care plans that include handling requirements
  - Languages required for effective communication
  - Workload issues
  - Workers wearing appropriate clothing and footwear
  - Communication protocols for patient status information
  - Patient lifting and transfer plans
  - Trained staff
  - Preventive and reparative maintenance programs for equipment in place
  - Sufficient space to perform tasks, including use of mechanical lifts
  - Walkways free of clutter
  - Floor surfaces in good order
  - Stable, suitable furniture
  - Electric, adjustable beds

- Adequate lighting for tasks

Patient factors including:

- Capability to bear weight, move normally, tolerate basic tasks
- Patient conditions that may impact risk such as history of falls, impaired movement, pain, loss of sensation, skin issues, communication issues, medical equipment used, surgical conditions, sensory deficiencies, mental state (confusion), aggression, etc.
- Types and frequency of transfers, lifts, repositioning required

Task factors including

- Static positions that may be required
- Duration of task
- Awkward postures for caregivers
- Task requiring extended reach
- Restrictions posed by protective equipment
- Inflexibility of time for task

8. Criteria for glove selection include:

- a. The nature and concentration of the chemicals.
- b. The amount of time the gloves will be exposed to the chemical.
- c. Dexterity required to perform the task.
- d. Extent of protection needed (to wrist or higher).
- e. Decontamination and disposal requirements.

9. Criteria for the selection of eye protection include:

- a. Level of protection required.
- b. Comfort of the wearer.
- c. Secure fit that does not interfere with vision or movement.
- d. Ease of cleaning and disinfection.
- e. Durability.
- f. Compatibility with prescription glasses and other PPE that must be worn at the same time (e.g. respirators).

10. Administrative controls may include safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions; waste handling procedures; education of workers in the nature of the hazard; availability of appropriate equipment and PPE; accommodation for workers with special needs (pregnant workers, persons with sensitivities or other health issues).

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