VOLUME 4

Best Practices for the Assessment *and Control of Physical Hazards*

Best Practices Guidelines for Occupational Health and Safety in the Healthcare Industry

Government of Alberta

WORK SAFE ALBERTA

Credits

This document has been developed by the Government of Alberta, with input from:

- Alberta Employment and Immigration
- Alberta Health Services
- Alberta Continuing Care Safety Association
- The Health Sciences Association of Alberta (HSAA)
- United Nurses of Alberta
- Alberta Union of Provincial Employees
- Alberta Home Care and Support Association
- Alberta Health and Wellness

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This Guidance Document is current to May 2011. The law is constantly changing with new legislation, amendments to existing legislation, and decisions from the courts. It is important that you keep up with these changes and keep yourself informed of the current law.

This Guidance Document is for general information only and may be applicable to assist in establishing of a compliant health and safety system at your work site. However, it is critical that you evaluate your own unique circumstances to ensure that an appropriate program is established for your work site. It is strongly recommended that you consult relevant professionals (e.g. lawyers, health and safety professional and specialists) to assist in the development of your own program.

This document is available on the website at:
www.employment.alberta.ca/ohs-healthcare

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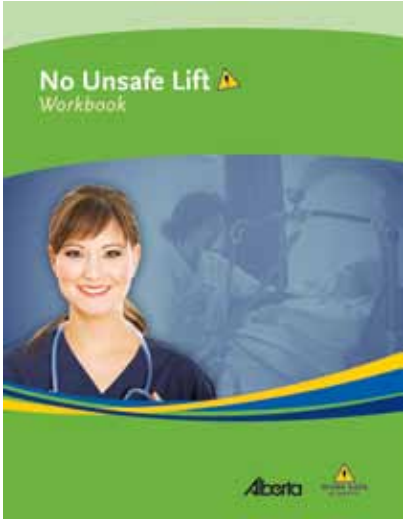
Section 1

Overview

Section 1: Overview



This is the fourth volume in a series of five manuals that describe methods for employers and workers in the healthcare industry to improve occupational health and safety. Unique to this best practice volume is that it is a companion document to the *No Unsafe Lift Workbook* – where the features of safe patient handling are described.

Patient Handling is the predominant physical hazard in the healthcare sector. The *No Unsafe Lift Workbook* was developed to focus on this leading healthcare hazard. For more information on patient handling hazard assessment and control refer to: **www.employment.alberta.ca/ohs-healthcare.**

Together, this document and the *No Unsafe Lift Workbook* combine to provide a comprehensive summary of best practices that have been shown to be effective in controlling the leading physical hazards in the healthcare industry. Please note, the physical hazards associated with workplace violence and working alone will be addressed in the "Best Practice for Controlling Psychological Hazards in Healthcare".

Healthcare workers are exposed to a variety of potential physical hazards in their daily work. Physical hazards include biomechanical hazards, radiation, noise, extreme temperatures, pressurized systems, confined spaces, falling hazards, electrical hazards, etc. Physical hazards should be identified, assessed and ultimately controlled for all healthcare positions. The healthcare work environment and functions are variable and the range and complexity of physical hazards is diverse. This best practice document will address key physical hazards that exist in the healthcare work environment that have been responsible for injuries and illnesses of healthcare workers.

A best practice is a program, process, strategy or activity that:

- Has been shown to be effective.
- Can be implemented, maintained, and evaluated.
- Is based on current documented information.
- Is of value to, or transferable to, other organizations.

Best practices are living documents and must be reviewed and modified on a regular basis to assess their validity, accuracy, and applicability. They may exceed, but cannot be less than, the requirements of Occupational Health and Safety (OHS) legislation.

In Alberta, the requirements for occupational health and safety are outlined in the *Occupational Health and Safety Act (OHS Act), Regulation (OHS Regulation)* and Code (OHS Code). The *Act, Regulation* and Code are available for viewing or downloading on the Alberta Government, Occupational Health and Safety (OHS) website at **www.worksafe.alberta.ca.** This document does not replace the *OHS Act, Regulation* and Code and does not exempt anyone from their responsibilities under the legislation.

Resources

Official printed copies of the Alberta *OHS Act, Regulations,* and Code may be purchased from the Queen's Printer at **www.qp.alberta.ca** or:

Edmonton
Main Floor, Park Plaza
10611- 98 Avenue
Edmonton, Alberta T5K 2P7

Phone: 780-427-4952 Fax: 780-452-0668
Toll-free in Alberta via 310-0000

How this document is organized

This document approaches the examination of physical hazards in the healthcare setting by identifying types of physical hazards, outlining the scope and complexity of the physical hazards, reviewing assessment strategies, and discussing control methods. Finally, a scan of the healthcare environment identifies major functional areas, potential physical hazards and control methods.

How to use this document

This best practice document is designed to be used to assist those responsible for the design and implementation of occupational health and safety programs with a specific focus on physical hazards. A companion document, the *No Unsafe Lift Workbook,* addresses patient handling issues. For more information on patient handling hazard assessment and control, refer to: **www.employment.alberta.ca/ohs-healthcare.**

Sections in this document will be useful for healthcare employees and employers in developing hazard assessments and determining appropriate control measures. The volume draws from published literature (see Appendix 1) to provide information about practices that are widely considered to be effective in developing and improving OHS programs with respect to physical hazards.

Consider these Alberta OHS Resources for obtaining more information:

- Alberta Government **www.employment.alberta.ca/ohs-healthcare**
- Alberta Continuing Care Safety Association.
- Your organization's Occupational Health and Safety Department.
- Your organization's Occupational Health and Safety Committee.
- Your union Occupational Health and Safety Representative.
- Your department Occupational Health and Safety Representative.

Resources

Section 2

Roles and Responsibilities

SECTION 2: Roles and Responsibilities

The Alberta *Occupational Health and Safety Act, Regulation,* and Code combine to set out the legal requirements that employers and workers must meet to protect the health and safety of workers. These are **minimum** requirements.

General Responsibilities

Employers must ensure, as far as reasonably practical, the health and safety of all workers at their work site.

Employers must:

» Assess a work site and identify existing or potential hazards.

» Prepare a written and dated hazard assessment.

» Review hazard assessments periodically and when changes occur to the task, equipment or work environment.

» Take measures to eliminate or control identified hazards.

» Involve workers in the hazard assessment and control process.

» Make sure workers and contractors are informed of the hazards and the methods used to eliminate or control the hazards.

Workers must:

» Take reasonable care to protect the health and safety of themselves and other workers.

» Cooperate with their employer to protect the health and safety of themselves and other workers.

OHS Act, Section 2; OHS Code, Part 2

Legislated Requirements

Worker Exposure to Physical Hazards

In Alberta, there are legal requirements to protect the health and safety of workers from exposure to physical hazards in the workplace. The Alberta *OHS Act, Regulation* and Code have specific references to the identification and control of physical hazards in addition to general responsibilities. The table on page 12 summarizes specific legislative references as they relate to the physical hazards referenced in this resource (note - the table is not exhaustive).

Information

Physical Hazards	Legislative References
Biomechanical Hazards (patient handling)	OHS Code Part 14 – Lifting and Handling Loads
Biomechanical Hazards (non-patient handling)	OHS Code Part 14 – Lifting and Handling Loads
Radiation	OHS Code Part 20 – Radiation, *Radiation Protection Act* and *Regulation*
Falling Hazards	OHS Code Part 8 – Entrances, Walkways, Stairways and Ladders; Part 9 – Fall Protection
Cutting Hazards	OHS Code Part 35 – Health Care and Industries with Biological Hazards
Noise Hazards	OHS Code Part 16 – Noise Exposure
Pressure Hazards	OHS Code Part 10 – Fire and Explosion Hazards
Confined Spaces	OHS Code Part 5 – Confined Spaces
Electrical Hazards	OHS Code Part 15 – Managing the Control of Hazardous Energy; Part 22 – Safeguards; Part 17 – Overhead Power Lines
Vehicle Driving Hazards	OHS Code Section 19 – Powered Mobile Equipment
Mechanical Hazards	OHS Code Part 15 – Managing Hazardous Energy; Part 22 – Safeguards; Part 25 – Tools, Equipment and Machinery
Lifting Devices	OHS Code Part 6 – Cranes, Hoists and Lifting Devices; Part 21 – Rigging
Fire / Explosion Hazards	OHS Code Part 10 – Fire and Explosion Hazards

Did you know?

In addition to the requirements for physical hazards outlined in the Alberta *OHS Act, Regulation* and Code, there are requirements contained in other legislation such as the Alberta Fire Code, *Radiation Protection Act* and *Regulation,* Canadian Electrical Code etc. Employers must be knowledgeable of and adhere to these legislative requirements as well.

Section 3

Best Practice Features of an Injury and Illness Prevention Program

Section 3 - Best Practice Features of an Injury and Illness Prevention Program

The first volume of this series "Overview of Occupational Health and Safety in the Healthcare Industry" examined elements that are common to effective injury prevention programs. In this section, the review will focus on program elements integral to the control of physical hazards in the healthcare setting. The subsequent sections of this volume will provide expanded detail regarding the identification, assessment and control of physical hazards.

Management Commitment and Leadership

Senior management in each healthcare organization must provide clear direction and support for the occupational health and safety program, and specifically the program elements targeted to reduce the risk of injury and illness as a result of physical hazards. Key roles for senior management include providing appropriate resources as well as reviewing and approving policies that relate to physical hazards.

Hazard Identification and Assessment

The hazard identification and assessment process must consider all types of physical hazards which may result in injuries or illness. Ideally, all jobs/tasks in an organization are evaluated for hazards in a systematic and proactive manner. Once the hazards are identified, they are then assessed based on risk in order to identify the relative priority of specific hazards for controls. Workers and managers who participate in hazard assessment and control should be educated to identify physical hazards in their workplace.

Hazard Control

The control of physical hazards must follow the hierarchy of hazard controls as identified in the Alberta OHS Code Part 2. The goal is to eliminate the hazard. If this is not possible, the next control strategy is the use of engineering controls. Engineering controls are a preferred method of controlling physical hazards. The next level of control is administrative which focuses on behaviours and work methods. The third line of defense is the use of personal protective equipment (PPE). The effective use of PPE relies on proper selection, use, fit and worker training. If PPE fails, there is a high likelihood that the worker will be exposed to the hazard. In many cases, hazards are controlled effectively through a combination of hazard control strategies.

Examples of Engineering Controls for physical hazards

- Substitution of a hazardous process with a less hazardous process.
- Process modification.
- Isolation.
- Use of material handling equipment (to replace manual handling).
- Guarding, shielding and barriers.
- Automated processes.
- Enclosures.
- Safety engineered medical devices.
- Ergonomically designed equipment and facilities.

Examples of Administrative Controls for physical hazards

- Policies and procedures.
- Orientation and training.
- Purchasing standards and procedures.

- Work scheduling.
- Job rotation.
- Exposure monitoring specific to the hazard (e.g. noise, radiation, etc.).
- Health assessments appropriate to the hazard (e.g. audiometric tests for noise exposure).
- Warning signs.
- Maintenance and cleaning programs.
- Separate lunchroom and break facilities.

Examples of Personal Protective Equipment for physical hazards

- Gloves.
- Eye protection.
- Protective clothing.
- Head protection (e.g. hard hats).
- Footwear.
- Hearing protection.
- Respiratory protection.
- Lead aprons (radiation).

Workplace Inspections

A key strategy to proactively identify physical hazards in the workplace is worksite inspections. Planned worksite inspections can be used to identify previously unrecognized hazards in the workplace and ensure that control measures are functioning properly. An inspection process should identify who is responsible to conduct inspections and what training is required for the inspectors. A checklist should be used as a guide to the inspection team to ensure that certain processes, facilities and equipment are evaluated. The checklists should incorporate key physical hazards and related controls such as cleanliness and housekeeping, lighting levels, tripping hazards, ergonomic work practices, ergonomic equipment (e.g. appropriate carts, lifting devices), fire controls, etc. It is essential that deficiencies identified through workplace inspections are rated according to risk and corrected in an effective manner.

Incident Reporting and Investigation

An effective incident reporting and investigation program is an essential element of a successful OHS management system. It is important that incidents (including near miss incidents) are reported and thoroughly investigated in an effort to identify the immediate and root causes.
In the context of physical hazards, incident investigations may reveal previously unrecognized hazards or control measures that are inadequate. It is imperative for healthcare organizations to learn from all incidents to prevent future injuries, illnesses and near misses.

Section 4

Hazard Assessment

Section 4: Hazard Assessment

Hazard assessment and control is at the foundation of occupational health and safety and is a requirement for all work sites under Alberta OHS legislation.

Legislated Requirements

What is a Hazard?

A hazard is any situation, condition, or thing that may be dangerous to the safety or health of workers.

OHS Code, Part 1

How to identify physical hazards in the workplace

As with all other hazards, physical hazards that may be encountered in the workplace must be identified. The first step in a physical hazard assessment is to list the job tasks that the worker performs and identify the environmental considerations. These tasks must include actual and potential physical exposures in the workplace. Once the tasks have been identified, the risks presented by these exposures must be assessed and controls implemented to protect workers. The physical environment and environmental conditions must also be considered as they may pose hazards to workers.

Focus

How to assess and control physical hazards in the workplace

Step 1: List tasks that the worker performs and the environmental considerations where the worker works.

Step 2: Identify physical hazards the worker may be exposed to.

Step 3: Identify the potential for exposure to physical hazards through the various mechanisms and routes of entry for the hazard.

Step 4: Assess the hazard and determine the risk for exposure.

Continued on page 22.

Continued from page 21.

Focus

Step 5: Identify appropriate controls following the hierarchy of controls.

Step 6: Communicate the information to workers (and Joint Health and Safety Committee if one exists) and provide training.

Step 7: Evaluate the effectiveness of controls and improve them as required.

Checklist

Are physical hazards being properly identified and assessed?

- □ Do hazard assessments include physical hazards?
- □ Are all types of physical hazards considered in the hazard assessment process?
- □ Have previous records of exposure been used to assist in identifying potential sources of exposure?
- □ Are records of industrial hygiene monitoring maintained and reviewed?
- □ Are frontline workers (and Joint Health and Safety Committee if one exists) actively involved in the hazard identification and risk assessment process to ensure accuracy and completeness?
- □ Are communications effective in ensuring that employees are aware of physical hazards?
- □ Are hazard assessments repeated periodically or whenever changes to processes are made?

For further information on Hazard Assessment and Control

» See Volume 1 – Overview of Best Practices in Occupational Health and Safety in the Healthcare Industry at **www.employment.alberta.ca/ohs-healthcare.**

» Access the Alberta Government's Hazard Assessment and Control eLearning Program at **www.employment.alberta.ca/whs/learning/hazard/Hazard.htm.**

Resources

Determination of appropriate controls

Controls chosen to protect workers should reflect the hierarchy of controls, with elimination of the hazard considered first, followed by engineering controls, then administrative controls, and PPE last. Appropriate controls must be provided to healthcare workers (HCWs) based on hazard assessment, and the use of controls must be required and enforced. Workers should be trained in the hazards and proper use of controls. Hazard controls must be maintained to ensure their ongoing effectiveness. Where PPE is listed as a control, appropriate types and sizes must be available; appropriate fit testing, training and PPE maintenance are required.

Are appropriate controls identified, supplied and used?

- □ Where possible, are mechanisms to eliminate the hazard at the source identified?
- □ Are engineering controls identified and implemented?
- □ Are workers involved in the determination and selection of hazard controls?
- □ Does the selection of controls take into account the mechanism of injury or route of entry?
- □ Are all required controls available where needed?
- □ Is the use of identified hazard controls required?
- □ Are workers provided with training on the proper use of controls?
- □ Are workers informed if an engineering control is not functioning properly?

Checklist

The following form is a sample that can be used for the process:

Hazard Assessment and Control Sheet (Sample)

- List all identified hazards (and consider any worker health or sensitivity issues),
- Identify the controls that are in place—engineering, administrative, PPE, or combination—for each hazard.

Job or Task	Potential or Existing Hazard	Hazard Risk Assessment	Controls in Place			Follow-up Action Required	Date and Person Responsible
			Engineering	Administrative	PPE		
Perform diagnostic X-rays	*Exposure to ionizing radiation*	*Possibility of exposure to ionizing radiation* *Probability, Severity, Frequency assessment leading to assessment of risk as High, Medium or Low*	*Workplace design* *Shielding* *Distance between worker and radiation emitting device*	*Inspection and registration of x-ray equipment* *Radiation Protection Program* *Limit duration of time when exposure is possible* *Routine personal monitoring (dosimetry)* *Job rotation* *Safe work procedures* *Training*	*Shielding aprons (lead)*	*Consider purchasing lighter weight aprons*	*Sue Brown – September 2009*

List potential or existing hazards here.

Identify controls that are in place. If you wish you may identify them by type of control.

Identify if there is any follow-up action required, such as more training or PPE.

Fill in name of person who is responsible for implementing controls.

Section 5

Physical Hazards and Controls

Biomechanical Hazards

Ergonomics is the science and art of fitting the job to the worker. Without ergonomic considerations in the design of work, workstations and equipment, the demands of the work may be excessive and result in worker injuries.

Musculoskeletal injuries (MSIs) are a serious issue for all workplaces in Alberta including healthcare. MSIs can affect the soft tissue of various parts of the body including neck, back, shoulder, upper extremity and lower extremity and can be related to a specific event (acute) or long term exposure (chronic). MSIs include the common sprain and sprain injuries as well as repetitive strain injuries (RSIs), cumulative trauma disorders (CTDs), work related upper limb disorders (WRULDs), etc. Familiar names for specific types of MSIs include thoracic outlet syndrome, tendonitis, carpal tunnel syndrome, tennis elbow, golfer's elbow, etc. Regardless of the name, the injuries can have a significant impact on work performance as well as quality of life for healthcare workers. A worker in pain has difficulty concentrating, resulting in potential decreases in quality care and performance. A worker with restricted movement may not be able to complete tasks or may only be able to complete the tasks by putting his or her body into awkward positions that can contribute to additional injuries. Also, MSIs may affect home life by impacting family responsibilities, relationships and recreational activities.

Musculoskeletal injuries

If a worker reports to the employer what they believe to be work related symptoms of an MSI, the employer must review the activities of the worker to identify work-related causes of the symptoms, if any, and take corrective measures to avoid further work-related injuries.

OHS Code, Part 14

Legislated Requirements

Signs and Symptoms of a Musculoskeletal Injury

It is important that workers and the employer recognize the signs and symptoms that could indicate the development of MSIs. Signs (which can be observed) may include swelling, redness, and difficulty moving a specific body part. Symptoms (which can be felt but not observed) may include numbness, tingling, and pain. Signs and symptoms of MSIs may occur suddenly (as a result of a specific incident) or they may arise over a period of time in a gradual manner. It is important that workers are trained to identify and report the signs and symptoms of MSI immediately in order to obtain appropriate treatment and to identify and correct potential biomechanical risk factors in the workplace. In Alberta, there is a legal requirement under the OHS Code for the employer to follow up when a worker reports MSI symptoms in order to review the work activities, identify work-related causes and implement corrective actions to prevent further injuries.

The signs and symptoms of MSIs tend to follow stages:[1]

Stage 1 – Early Stage:

Discomfort may persist for weeks or months but is reversible. Most workers experience aching and weakness during work activities, but the symptoms improve with rest (e.g. during rest breaks, overnight and during days off). Interference with work performance is minimal.

Stage 2 – Middle Stage:

Discomfort may persist for months. Symptoms begin more quickly during work activities and last longer. Physical signs may be present. Sleep may be disturbed. Work tasks may be difficult to perform.

Stage 3 – Late Stage:

Discomfort may persist for months or years. Symptoms are present even at rest. Activities of daily living are disrupted and sleep is disturbed. The worker is unable to perform job duties. The likelihood of recovery is poor.

1 Alberta Government; *Musculoskeletal Injuries Part 2 – Symptoms and Types of Injuries;* August 2000.

The earlier a worker reports and receives treatment for MSI symptoms, the better the likelihood of a full and timely recovery. The employer has a responsibility to investigate the work-related causes of the MSI and put corrective measures in place to prevent further injuries. The employer also has a legal responsibility to report work-related injuries to the Workers' Compensation Board.

Focus

Training to Prevent Musculoskeletal Injuries

Workers who may be exposed to the possibility of MSI must be trained in specific measures to eliminate or reduce that possibility. The training must include the factors that could lead to MSIs, the signs and symptoms of MSIs as well as potential health effects and preventative measures.

OHS Code, Part 14

Legislated Requirements

Risk Factors

Biomechanical Risk Factors

The following biomechanical risk factors should be identified in the workplace in order to put control strategies in place, and thereby reduce the risk of MSIs.

1. Awkward or Sustained Postures.
2. Excessive Forces.
3. Repetition.
4. Compression/Impact Forces.

The mere presence of biomechanical risk factors may not result in an injury. The risk of developing an MSI depends on the magnitude and duration of exposure to the risk factors. For example, increased force and duration of exposure are related to greater risk of discomfort and injury. In addition, the presence of two or more biomechanical risk factors significantly increases the risk of discomfort and injury. It should be noted that there are other risk factors for the development of MSIs associated with the work environment (e.g. cold temperature), psychosocial factors, vibration, workstation design and personal factors.

1. Awkward or Sustained Postures

Awkward postures occur when workers adopt non neutral positions to perform a work task. The awkward posture may be due to the nature of the work or the design of the workstation, equipment or tools. A neutral body posture is a person standing upright with their arms hanging comfortably at the sides. In general, joints are considered to be in a neutral position when they are used in the middle of their range of motion. The farther a joint moves to the ends of its range of motion, the more awkward the posture, and the more strain is put on the muscles, ligaments and bones of the joint. Awkward postures result in an increased mechanical load on the musculoskeletal system and may impede blood flow. Awkward postures may occur repetitively (e.g. reaching repeatedly for an object) or the awkward posture may be sustained. Examples of awkward postures include bending forward at the waist, twisting the neck, extending the arms above the shoulders, twisting the back, etc. Healthcare positions that may include awkward and static postures include sonographers and microscopists.

Sustained (or static) postures are postures that are maintained for prolonged periods without giving the body a chance to change positions. The risk associated with sustained postures relates to decreased blood flow to the musculoskeletal system and may lead to undesirable changes in tissues associated with the muscles, tendons and ligaments. As an example, prolonged loading of connective tissue, such as the ligaments connecting the vertebrae in the back, can lead to stretching and permanent distension of the tissue. The resulting slack ligaments and instability in the spine may lead to an increased risk of a back injury.

Sonographer demonstrating awkward postures[2]

1) Shoulder abduction

2) Wrist flexion

2 Occupational Health and Safety Agency for Healthcare in British Columbia; *Project Update: Design of an Ergonomic Workstation to Reduce Risk of Musculoskeletal Injury in Diagnostic Medical Sonographers*; 2003.

2. Excessive Forces

Force is an exertion performed to overcome the weight, resistance, or inertia of the body or the work object. Excessive forces may be required when the forces necessary to perform a task overload the musculoskeletal system of a worker. The muscles, ligaments and tendons of the body can be overloaded when a worker applies high forces against an object. Excessive forces can be categorized by the type of activity being performed by the worker: lifting; lowering and carrying; pushing or pulling; and gripping.

Lifting, lowering and carrying activities require the worker to generate force. The amount of force required, for example to lift an object, is impacted by many factors including the weight of the object, size and shape of object, starting height of lift, finishing height of lift, etc. Healthcare positions that involve patient lifting, transferring and repositioning are likely to involve high forces and may occur in a variety of settings including acute care, long term care and home care settings. In the case of lifting, transferring and repositioning patients, human variables are an important consideration in evaluating the task.

Pushing and pulling requires a worker to generate force as well. It is generally recognized that pushing is less demanding on the worker than pulling as it involves larger muscle groups and alleviates the need to twist. Examples of healthcare positions involving pushing and pulling include patient transport / porter, laundry, materials management, food services, home care, etc.

High grip forces situations include gripping objects/tools that are too large or small to grip effectively; gripping slippery and odd shaped objects; using a pinch grip to generate high forces (rather than a power grip); gripping a vibrating tool; gripping an object/tool with bulky gloves; gripping in a cold environment, etc. Examples of healthcare positions that may involve high grip forces include dentistry, operating room and surgical suite, laboratory / autopsy, and maintenance.

3. Repetition

Repetition is a risk factor that relates to performing tasks that utilize the same muscle groups on a repetitive basis with little opportunity for a rest or change of task. The risk of injury associated with repetition increases with higher forces, higher frequency (cycle time) and overall duration of the repetitive task. The speed of motion and the recovery time between exertions are important factors in evaluating the risk. Highly repetitive tasks may result in fatigue, tissue damage, discomfort and pain. Examples of healthcare positions that may involve high repetition include health records (e.g. data entry), pharmacy (e.g. crushing pills) and laboratory (e.g. manual pipetting).

4. Compression/Impact Forces

Compression and impact forces are risk factors for MSIs when forces are concentrated over small areas of the body which may result in the pinching or crushing of tissue, often leading to discomfort and pain. An example of compressive forces (or local contact stress) is a worker leaning his wrist or forearm on the hard and/or sharp edge of a work surface. Another example is a worker using a tool with a hard and shaped handle that presses into the hand. Susceptible parts of the body include the sides of fingers, palms, wrists, forearms, elbows and knees where nerves, tendons and blood vessels are close to the surface of the skin and close to bones.

Psychosocial Risk Factors

In addition to biomechanical factors, research has shown that psychosocial aspects of the work can impact the risk of developing MSIs. Psychosocial risk factors are attributes of the job and the work organization which may affect the worker's psychological response to their work. In order to implement the best control strategy, it is important to identify and control both physical and psychosocial risk factors. Detailed coverage of these and other psychological hazards will be reviewed in Volume 5 of the Best Practice series.

Controls

The risk of work related MSI can be reduced by applying ergonomic controls. A systematic approach to addressing biomechanical hazards is the most effective approach in reducing risk factors, preventing injuries and improving productivity and efficiency. Control strategies can be organized into four elements, including workstation design, equipment and tools, work environment, and work organization.

Key Components of an Effective Ergonomics Program

Effective ergonomics programs have similar characteristics which include:

- Full commitment by all levels of management, especially top management.
- Involving workers in all levels of the program.
- Providing training and education on ergonomic risks, appropriate controls and advice to report early symptoms to supervisors.
- Identifying, evaluating, and setting priorities to modify problem work areas and jobs.
- Identifying specific risk factors in the job task or work station design.
- Eliminating or reducing potential problem areas.
- Documenting and reporting symptoms to a supervisor if the symptoms persist.
- Ensuring employees receive prompt medical attention.

Engineering Controls

Engineering controls are recognized as the most effective category of hazard controls. Examples of general engineering controls that apply to biomechanical hazards include:

- Change the process through automation to eliminate the hazard.
- Use handling equipment (e.g. lifts, hoists, etc.) to reduce manual handling.
- Modify the design of workstations, hand tools, equipment, etc. to reduce the hazard.

Administrative Controls

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. Specific controls include:

- Establishing ergonomic purchasing standards for tools, equipment and office furniture.
- Conducting user trials to test new equipment and tools with input from workers.
- Maintaining equipment, workstations and tools to optimize their operation.
- Developing work practices to reduce biomechanical hazards.
- Providing training programs to educate workers regarding biomechanical risk factors, signs and symptoms and safe work practices (including proper lifting methods).
- Providing self assessment tools to identify and control biomechanical hazards.
- Performing ergonomic assessments to identify hazards and implement controls.
- Implementing job rotation designed to move workers between jobs that utilize different muscle groups.
- Using job expansion to integrate a variety of tasks that utilize different muscle groups and address repetition and mental demands.
- Optimizing work shift scheduling to minimize extended work hours and overtime.
- Designing break schedules to reduce biomechanical hazards.
- Using micro-breaks to give the body a chance to change posture and recover.
- Encouraging monitoring and early reporting of the signs and symptoms of MSIs.
- Establishing a policy to ensure furniture and equipment in rooms do not restrict the ability to safely use patient lifting devices.

Back belts and other controversies[3]

Back Belts

Back belts are **not** recommended as a strategy to prevent back injuries for employees who perform Manual Materials Handling (MMH) tasks. According to the National Institute for Occupational Safety and Health[4] (NIOSH), there is no evidence that back belts reduce the incidence of back pain or back injury claims.

Wrist splints[5]

Splints are designed to reduce the risk of using a joint or limb in a way that may aggravate an injury. The goal is to keep the joint in a neutral position. Wrist splints are often prescribed by a doctor for people to use during sleep in order to prevent the wrist from being held in a flexed (bent) position. Unless advised by a doctor, wrist splints should **not** be worn during activities (work or otherwise) that involve the affected joint. The disadvantage is that a wrist splint used in the workplace "may result in an increased risk of injury to other joints (e.g. elbow and shoulder) as they compensate for the lack of mobility in the wrist."

Exercise balls as seats[6]

Exercise balls, also known as fitness or stability balls, have become a popular trend in exercise programs and in some rehabilitation programs. There is little evidence to support that the use of exercise balls as a seat in the office setting is advantageous and there are some definite drawbacks. The concerns include:

- The initially upright posture is soon lost and the worker often slouches because there is no full seat or back support.
- The ball is not stable and a worker may fall.
- The seated worker cannot swivel or move around the workstation.
- The seating height and back position cannot be adjusted.
- Exercise balls don't appropriately support the lower back and thighs.

3 Alberta Government; Workplace Health and Safety Bulletin: *Let's Back up a Bit – Some Truths about Back Belts;* April 2004; **www.employment.alberta.ca/documents/WHS/WHS-PUB-ph003.pdf**

4 NIOSH; *Back belts – Do they prevent injuries?* Publication No. 94-127; October 1996; **www.cdc.gov/niosh/docs/94-127/**

5 Alberta Government; Workplace Health and Safety Bulletin: *Wrist Splints and MSIs;* April 2004; **www.employment.alberta.ca/documents/WHS/WHS-PUB-erg025.pdf**

6 Alberta Government; Workplace Health and Safety Bulletin: *Exercise Balls instead of Chairs – Maybe Not;* February 2007; **www.employment.alberta.ca/documents/WHS/WHS-PUB-erg036.pdf**

Effectiveness of Controls

The effectiveness of ergonomic controls should be assessed using both short term and long term evaluation methods. In the short term, hazard assessment tools as well as symptom surveys and questionnaires with workers can be used to evaluate the hazard controls. In the long term, indicators to evaluate effectiveness include:

- Reduction in the incidence rate of musculoskeletal disorders.
- Reduction in the severity rate of musculoskeletal disorders.
- Increase in productivity or the quality of services and products.
- Reduction in job turnover or absenteeism.

Information

Participatory ergonomics[7]

Participatory ergonomics involves workers based on the simple fact that workers are the experts on their jobs. Advantages to participatory ergonomics include:

- Enhanced change effectiveness.
- Easier change implementation.
- Enhanced communication.
- Decreased psychosocial risk factors.
- The participatory process can be used as the model to address other workplace issues, with the same potential benefits.

Strategies to involve workers:

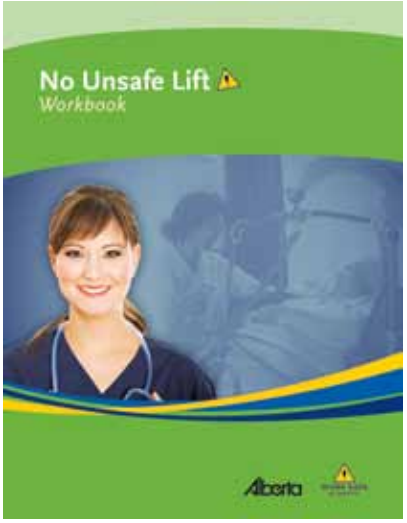
- Address ergonomics issues in the Joint Health and Safety or Ergonomics Committee.
- Provide Committee member training in ergonomic assessment and control strategies.
- Conduct user trials of new equipment and tools.
- Involve workers in the identification and assessment of ergonomic risk factors.
- Seek worker input on ergonomics issues including symptom surveys, ergonomic concerns and suggestions for improvement.
- Involve workers in the planning of new work areas, workstations and renovations.
- Obtain worker input on the effectiveness of ergonomic controls.

7 Wells, R.; University of Waterloo –Ergonomics and Occupational Biomechanics Laboratory; *Participatory Ergonomics Process*; February 2005; **www.ahs.uwaterloo.ca/~wells/making_ergonomics_changes.htm**

Biomechanical Hazards – Patient handling

The general ergonomic principles outlined earlier are important considerations to assist in controlling biomechanical hazards in the healthcare setting. However, specific attention must be focused on patient handling. Legislative requirements related to patient handling are highlighted in this volume and the Alberta *No Unsafe Lift Workbook* details hazard assessment and control specific to safe patient-handling.

The features of a safe patient handling program are comprehensively addressed in the companion document: The *No Unsafe Lift Workbook*, available at **www.employment.alberta.ca/ohs-healthcare.**



Patient/client/resident handling

The employer must develop and implement a safe patient/client/resident handling program if workers are required to lift, transfer or reposition patients/clients/residents. Employers must also ensure workers follow the program and evaluate the program annually. Workers must follow the safe patient handling program.

Legislated Requirements

Definition – Safe patient/client/resident handling

Lifting, transferring or repositioning by the use of engineering controls, lifting and transfer aids, or assistance devices, by lift teams or other trained staff rather than by sole use of worker body strength.

OHS Code, Part 1 and Part 14

Work site design – healthcare facilities

For all healthcare facility construction, alterations, renovations or repairs started after July 1, 2009, appropriate patient lifting equipment must be incorporated into the design and construction of new health care facilities and when existing facilities undergo renovation.

Legislated Requirements

OHS Code, Part 14

Biomechanical Hazards – Non-patient handling

This section examines biomechanical hazards associated with computer workstations, general biomechanical hazards in the context of healthcare and reviews the application of ergonomic principles to control biomechanical hazards.

Computer Workstations

The use of computers is ubiquitous in a variety of HCW positions and healthcare settings. The key biomechanical risk factors for computer use are awkward postures, excessive force, repetition and compression and impact forces. In addition to biomechanical risk factors, there may be other risk factors related to the work environment (e.g. lighting, noise), workstation design and personal factors. Examples of personal risk factors include state of health, fitness level, casual addictions (e.g. caffeine and smoking), poor posture, poor typing technique (e.g. pounding the keys), and poor typing posture (e.g. bent wrists). In addition to MSIs, it should be noted that the signs and symptoms related to poor computer workstation ergonomics may include eye fatigue and discomfort, and in some cases headaches.

Hazard Assessment

A self assessment is a useful tool to assist workers in evaluating biomechanical risk factors related to their computer workstations, and to provide recommendations for control measures. Ideally, healthcare organizations should provide workers with self assessment tools and when concerns persist, an ergonomics assessment should be performed by someone with specialized training. The goal of the hazard assessment is to identify hazards and control strategies to reduce the risk of injury.

Resources

Computer workstation ergonomics resources

Occupational Safety and Health Administration (OSHA) e-tools: Computer Workstation Checklist
www.osha.gov/SLTC/etools/computerworkstations/checklist.html

Occupational Health Clinics for Ontario Workers, Office Ergonomics Handbook
www.ohcow.on.ca/resources/workbooks/ergonomics.pdf

UCLA, Computer Workstation Self Evaluation
www.ergonomics.ucla.edu/Seval_Gen.cfm

Workers' Compensation Board – Alberta (WCB – Alberta); Office Ergonomics: Think Detection, Think Prevention, Think Activity
www.wcb.ab.ca/pdfs/public/office_ergo.pdf

Summary of Biomechanical Hazards and Controls for Computer Workstations

Computer Workstations	
Risk Factor	**Suggested Control**
Repetition	» Alternate tasks, consider job expansion. » Take frequent breaks from keying or using mouse.
Awkward Posture	» Sit supported against the back of the chair. » Adjust chair and workstation to allow neutral body postures. » Avoid bending or twisting the neck or trunk. » Keep shoulders low and relaxed and arms close to the sides. » Keep elbows at 90-110 degree angle when using the keyboard and mouse. » Keep wrists in a straight or neutral position when keying or using mouse (do not lean wrist on hard edges of workstation). » Keep fingers relaxed when keying or using mouse. » Keep work materials in easy reach. » Use a telephone headset for frequent/ prolonged phone use. » Change positions/tasks frequently.
Force / Compression	» Key with a light touch (do not pound the keys or grip the mouse tightly). » Avoid prolonged or excessive grasping of the mouse. » Use ergonomically designed equipment and tools such as: – larger diameter pens to reduce grip when writing. – electric staplers for large jobs. – ergonomically designed three-hole punches. » Avoid resting elbows or wrists on the edge of the work surface.
Environmental	» Reduce glare on the computer by adjusting its placement. » Use an anti-glare screen or close window blinds to control glare. » Rest eyes intermittently by focusing on distant objects and taking visual breaks. » Remember to blink often when viewing the monitor.

Information

Hazard Controls for Computer Workstations

Engineering Controls

» Provide ergonomically designed equipment and furniture – The goal is to purchase and provide equipment and furniture that will support ergonomically correct work postures and behaviours.

» Design workstation layout and arrange equipment to minimize biomechanical risk factors. For example, frequently accessed equipment and materials should be located in easy reach (and located to minimize awkward postures).

Resources

Purchasing standards

The following references are useful in the development of purchasing specifications for office equipment and furniture:

» Canadian Centre for Occupational Health and Safety; Purchasing Ergonomic Office Furniture
www.ccohs.ca/oshanswers/ergonomics/office/purchase.html

» OHSA; E-tools: Purchasing Guide Checklist
www.osha.gov/SLTC/etools/computerworkstations/checklist.html#purchase

» Canadian Standards Association (CSA); Standard CSA-Z412 *Guidelines on Office Ergonomics*
www.ohs.csa.ca/standards/ergonomics/Office/Z412-00.asp

Administrative Controls

» **Policies –** Ergonomic policies to address the computer ergonomics program including purchasing standards, ergonomic assessments, training and awareness and reporting of concerns.

» **User Trials –** A system to test furniture and equipment prior to purchase in order to get input from the users and to verify that the equipment is suitable to the work environment, tasks and demographics of the workplace.

- **Training –** Education in computer ergonomics to increase employee awareness of risk factors, signs and symptoms of injury, self assessment tools, and controls.
- **Ergonomic Assessments –** Provide ergonomic self assessment tools for workers to identify and correct workplace hazards. Provide additional resources to perform ergonomic assessment if the self assessment process has not been effective.
- **Varying Work Tasks and Work Positions –** Recommend that workers break from or vary their work tasks for 5-10 minutes for every hour spent at a workstation. Break up keyboarding tasks by doing other job duties or tasks that involve moving around or changing body position. Workers should be encouraged to stand up and move around, whenever possible, and look away from the screen occasionally and focus the eyes on an object far away. Workers should take regular rest breaks to ease muscle aches and eye strain, relax the muscles, stretch and change position.
- **Micro-breaks –** The use of short breaks to give the body a chance to change position in an effort to vary posture, improve blood flow and recover from static postures.
- **Early Reporting of Signs and Symptoms –** Educate workers regarding the signs and symptoms of MSIs and encourage early reporting. The goal is to investigate MSI concerns before the injury becomes chronic and control the risk factors.

General Biomechanical Hazards

Manual Material Handling

Manual material handling (MMH) includes a variety of tasks such as lifting, lowering, pushing, pulling, and carrying of objects. The greatest risk of injury is associated with back injuries, but injuries may also affect the upper and lower extremities. There is a lot of manual handling in healthcare, for example, pushing carts (food service, laundry, supply and crash carts) and lifting materials.

Legislated Requirements

Assessing manual handling hazards

Before a worker manually lifts, lowers, pushes, pulls, carries, handles or transports a load that could injure the worker, an employer must perform a hazard assessment that considers the following:

» the weight of the load,

» the size of the load,

» the shape of the load,

» the number of times the load will be moved, and

» the manner in which the load will be moved.

Before a worker performs any manual patient/client/resident handling activities, an employer must perform a hazard assessment that considers the worker's physical and mental capabilities to perform the work.

If the hazard assessment determines that there is a potential for MSI, an employer must ensure that all reasonably practicable measures are used to eliminate or reduce the risk.

OHS Code, Part 14

Identification of Risk Factors – The Perspective from British Columbia

The British Columbia Workers' Compensation Board has identified specific requirements in the *Occupational Health and Safety Regulation*[8] to address ergonomics and the identification of MSI risk factors in the workplace. The systematic approach to identification of risk factors is a useful guide for implementation of an effective MSI prevention program. Consider these potential MSI risk factors:[9]

8 WorkSafeBC; *Occupational Health and Safety Regulation Part 4; Section 4.49;* December 2008; **www2.worksafebc.com/Publications/OHSRegulation/Part4.asp**

9 WorkSafeBC; *Understanding the Risks of Musculoskeletal Injury (MSI): An Educational Guide for Workers on Sprains, Strains, and other MSIs;* 2008; **www.worksafebc.com/publications/Health_and_Safety/by_topic/assets/pdf/msi_workers.pdf**

British Columbia Systematic Approach to Identification of MSI Risk Factors

The physical demands of work activities, including,

» Force required

» Repetition

» Duration

» Work postures

» Local contact stresses

Aspects of the layout and condition of the workplace or workstation, including,

» Working reaches

» Working heights

» Seating

» Floor surfaces

The characteristics of objects handled, including,

» Size and shape

» Load condition and weight distribution

» Container, tool and equipment handles

The environmental conditions, including cold temperature

The following characteristics of the organization of work

» Work-recovery cycles

» Task variability

» Work rate

Resources

Symptom survey:

National Institue of Occupational Safety and Health (NIOSH) Publication No. 97-117: Elements of Ergonomics Programs
www.cdc.gov/niosh/docs/97-117/pdfs/97-117-e.pdf

Manual material handling:

Alberta Government; Workplace Health and Safety Bulletin: Lifting and Handling Loads Part 2 – Assessing Ergonomic Hazards
www.employment.alberta.ca/documents/WHS/WHS-PUB-BCL002.pdf

WorkSafeBC; Push Pull Carry Calculator
www.healthandsafetycentre.org/ppcc/default.htm

WorkSafeBC; Worksheet A: MSI Risk Factor Identification
www.healthandsafetycentre.org/PPCC/resources/MSI_worksheet_a.pdf

WorkSafeBC; Worksheet B: MSI Risk Factor Assessment
www.healthandsafetycentre.org/PPCC/resources/MSI_worksheet_b.pdf

NIOSH; Applications Manual for the Revised NIOSH Lifting Equation
www.cdc.gov/niosh/docs/94-110/

EMC Insurance Companies; NIOSH Lifting Equation (calculator)
www.emcins.com/lc/niosh.htm

University of Michigan; 3D Static Strength Prediction Model
www.engin.umich.edu/dept/ioe/3DSSPP/index.html

Washington State Department of Labour and Industries – Caution Zone Checklist (WAC 296-62-05105) and Hazard Zone Checklist (WAC 296-62-05174);
www.lni.wa.gov/wisha/ergo/evaltools/CautionZones2.pdf;
www.lni.wa.gov/wisha/ergo/evaltools/HazardZoneChecklist.pdf

Handtools

NIOSH Publication No. 97-117: Elements of Ergonomics Programs Handtool Analysis Checklist
www.cdc.gov/niosh/docs/97-117/eptbtr5e.html

Ergonomics and pregnancy[10]

Many women work during pregnancy and may choose to work up until the birth of their child. Ergonomic factors are an important consideration to improve the comfort of pregnant workers and prevent injuries. During the later stages of pregnancy, greater demands are placed on the muscles of the lower back both for maintaining balance as well as when handling loads. Pregnant workers are at their greatest risk of injury during the last trimester.

The risk of developing the symptoms of carpal tunnel syndrome is increased during pregnancy. Pregnancy-related carpal tunnel syndrome is caused by swelling of the hands and arms. Some symptoms include pain, tingling, numbness, and reduced strength of the hand. Pregnant workers should be aware of the increased risk of pregnancy-related carpal tunnel syndrome and take preventative actions to reduce the risk, and if necessary, report any symptoms early.

Pregnant workers (particularly in the last trimester) should avoid the following risk factors:

» Physically strenuous work e.g. heavy lifting, repetitive lifting, etc.

» Work requiring balance.

» Loud noise.

» Shift work and long working hours.

» Un-adjustable workstations.

» Prolonged sitting or standing.

Control strategies to consider include:

» Providing an adjustable workstation.

» Varying work position and work tasks.

» Taking short walks (to maintain comfort and prevent swelling in the feet and ankles).

» While performing seated work, adjusting chair frequently to maintain comfort.

» Using a footrest to improve lower back comfort.

Focus

10 Adapted from Occupational Health Clinics for Ontario Workers; *Ergonomics and Pregnancy*; **www.ohcow.on.ca/resources/handbooks/ergonomics_pregnancy/Ergonomics_And_Pregnancy.pdf**

Controls for Manual Material Handling

The employer is required to eliminate or minimize the risk of MSI to workers. Possible solutions to manual handling hazards include the following options:

Engineering Controls

- 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, lift trucks or pallet jacks.
    - Avoid carrying wide or tall (bulky) loads; if possible redesign the load.
    - Provide handles for 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).

Administrative Controls

- Perform ergonomic assessments of manual handling tasks to identify and correct risk factors.
- Train workers to use correct body mechanics for pushing, pulling, and carrying.
- Reduce the forces required to push/pull/carry:
  - Reduce the weight or size of load (consider contacting the supplier or the shipping department to affect the load characteristics).
  - Maintain the wheels on carts in good working order.
    - Reduce the height of the load.
    - Keep the floor clean and free of debris.

Personal Protective Equipment

- Wear appropriate footwear to enhance friction and minimize slippage between the floor and shoes.
- Consider using gloves to enhance friction when handling loads.

Legislated Requirements

Equipment

Employers must provide, where reasonably practicable, appropriate equipment for lifting, lowering, pushing, pulling, carrying, handling or transporting heavy or awkward loads. The employer is responsible to ensure that workers use the equipment provided.

Workers must use the equipment provided.

OHS Code Part 14

If an employer provides equipment for lifting and handling loads, the workers must be trained in the safe operation of the equipment including the following:

- the selection of the appropriate equipment,
- the limitations of the equipment,
- the operators pre-use inspection,
- the use of the equipment,
- the operator skills required by the manufacturers specifications for the equipment,
- the basic mechanical and maintenance requirements of the equipment,
- loading and unloading of the equipment if doing some is a job requirement, and
- the hazards specific to the operation of the equipment at the worksite.

OHS Code Part 14; *OHS Regulation* Section 15

General Workplace Design

Workplace design is an important concept in ergonomic controls and includes four general categories; workstation design, equipment and tool design, work environment and work organization design.

Workstation Design

Well designed workstations eliminate or reduce the risk of MSIs. The design of workstations should incorporate information from the science of anthropometry which involves the gathering of information about human dimensions. Important principles for workstation design are to design for extremes and incorporate the ability for adjustment. For example, workstations should be designed to allow workers to easily reach all controls and objects involved in their work. The workstation design and task demands should not require workers to hold their arms away from their body or above shoulder height. Another example of workstation design principles relates to the height of work surfaces. Precision work conducted in a standing posture, such as assembling surgical instrument kits or writing, should be performed 5 cm above elbow height. Heavy work, such as folding laundry, performed in a standing posture should be performed on a work surface 10 – 25 cm below elbow height in order to optimize the worker's ability to use downward forces. Ideally, workstations are designed properly for the task and the population and then adjusted to accommodate the individual, as necessary. Examples from healthcare include the appropriate design of laboratory workstations, kitchen dishwashing workstations, laundry folding workstations and nursing unit workstations.

Elements of workstation design are listed below:

- Height of work surfaces
- Storage height
- Location of items
- Beveled or rounded edges on tables, ledges, and shelves
- Foot rails and footrests
- Anti-fatigue matting
- Sit-stand stools

Equipment and Tool Design

Well designed equipment and tools minimize the risk of discomfort and injury in workers. Key issues relate to the handle and grip design, handle size, grip surface, vibration, weight and balance and trigger design.

The following is a list of recommendations for laundry cart design[11]:

- Adjust carts to ensure that they do not exceed shoulder height. This allows carts to be pushed from behind rather than being pulled from one side.
- Maintain wheels on the carts in good condition.
- Install large diameter wheels or casters on carts that move heavy loads.

11 WorkSafeBC; *MSI Prevention Bulletin: Laundry in Health Care Facilities;* n.d.; **www.worksafebc.com/publications/Health_and_Safety/bulletins/msi/assets/pdf/msi8_laundry.pdf**

» Close in the backs of carts to reduce the precision required to place linens.

» Provide waist-high shelves for storing incontinence pads to avoid forward bending.

» Provide powered push-pull devices for carts that move heavy loads.

Principles for pushing and pulling[12]

Consider the following recommendations for pushing and pulling:

» Push whenever possible. Pushing is generally safer than pulling.

» Use two hands for pushing or pulling. **Do not** pull with arm extended behind body.

» Ensure that good visibility is possible without awkward motions such as twisting or stretching. When pushing a cart, move to the front corner of the cart to push.

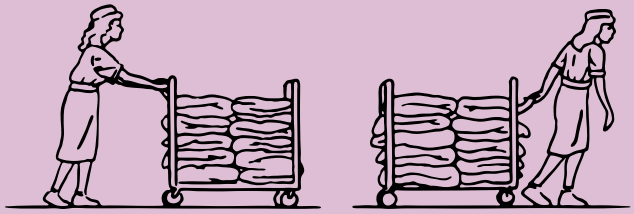
» Ensure that handles are between waist and shoulder height.

» Keep your upper arms against your rib cage with elbows in. Keep your hands at or slightly above waist level. Keep your feet shoulder width apart.

» Bend your knees slightly and move the load by shifting your weight. For example, with one leg in front of the other, bend your knees and move the load by shifting your weight from your back leg to your front leg.

» Take small steps when turning corners to avoid twisting your back.

» Ensure cart wheels are properly selected for the work task and environment and ensure that the cart wheels are properly maintained.



Whenever possible, push a load instead of pulling it.[13]

Focus

12 Occupational Health and Safety Agency for Healthcare in British Columbia; *An Ergonomics Guide for Kitchens in Healthcare; 2003.*

13 Alberta Government; *Workplace Health and Safety Teacher Resources Guide;* **www.employment.alberta.ca/documents/WHS/WHS-YW_teachers_resource_c8.pdf**

Work Environment

An ergonomic workplace incorporates the design and control factors required to provide an appropriate work environment. Key environmental factors to be considered include temperature and humidity, lighting, air quality, noise and vibration. Environmental aspects of the work environment are paramount to worker comfort and safety. A healthcare example related to a kitchen work environment would include environmental factors such as lighting, noise, humidity, temperature, etc.

Work Organization

Consideration to the way that the work is organized and the psychosocial environment of the workplace is vital. The following are work organization factors that can be considered in order to minimize the risk of injury and optimize work organization design:

- **Job rotation –** rotate workers between tasks or jobs that utilize different muscle groups to give the worker an opportunity to recover and minimize the risk of overuse.
- **Job expansion –** Design work to make greater use of workers' knowledge and skills and to provide workers with a range of tasks to perform.
- **Job pacing –** Reduce the emphasis on machine or system-paced work and ensure that workloads and deadlines are achievable.
- **Rest recovery and micro-breaks –** Educate workers and provide support for rest recovery cycles as well as micro-breaks.

Resources

Healthcare ergonomic resources

WorkSafe BC; MSI Prevention Bulletin 1:
General X-ray Technologist
www.worksafebc.com/publications/Health_and_Safety/bulletins/msi/assets/pdf/msi1_xray_tech.pdf

WorkSafe BC; MSI Prevention Bulletin 3:
Bed Making and Cleaning in Health Care
www.worksafebc.com/publications/health_and_safety/bulletins/msi/assets/pdf/msi3_bedmaking.pdf

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Resources

WorkSafe BC; MSI Prevention Bulletin 4: Room Cleaning in Health Care **www.worksafebc.com/publications/health_and_safety/bulletins/msi/assets/pdf/msi4_room_cleaning.pdf**

WorkSafe BC; MSI Prevention Bulletin 5: Floor Mopping **www.worksafebc.com/publications/health_and_safety/bulletins/msi/assets/pdf/msi5_floor_mopping.pdf**

WorkSafe BC; MSI Prevention Bulletin 7: Floor-Cleaning Machines **www.worksafebc.com/publications/health_and_safety/bulletins/msi/assets/pdf/msi7_floor_machines.pdf**

WorkSafe BC; MSI Prevention Bulletin 8: Laundry in Health Care Facilities **www.worksafebc.com/publications/Health_and_Safety/bulletins/msi/assets/pdf/msi8_laundry.pdf**

OSHA; Hospital eTool: Clinical Services Sonography **www.osha.gov/dcsp/products/etools/hospital/sonography/sonography.html**

Driving and Biomechanical Hazards

Many workers in healthcare drive as part of their daily work tasks and must deal with the ergonomic issues associated with driving, and in many cases transporting materials in their vehicles. It is important for drivers to remember to vary their work activities and work position frequently during the work day for optimal comfort. During long periods of driving, this may mean stopping at a safe location and getting out of the vehicle for a stretch or varying the adjustable seat controls slightly in order to maintain comfort.

Information

Initial driving position and posture guide[14]

Familiarize yourself with ALL adjustments (e.g. seat, steering, seat belt). Start by getting the seat into the 'initial set up position', where adjustable:

- Steering wheel fully up and fully forward.
- Seat height at its lowest.
- Cushion tilted so that front edge in lowest position.
- Back rest approximately 30 degrees reclined from vertical.
- Lumbar support adjustment backed off.
- Seat fully forward.

1. Raise the seat as high as is comfortable to improve your vision of the road.

- Check you have adequate clearance from the roof.
- Ensure you have maximum vision of the road.

2. Move the seat forward until you can easily fully depress the clutch pedal and accelerator pedal (maintain a safe distance from the air bag).

- Adjust seat height as necessary to give good pedal control.

3. Adjust cushion tilt angle so that the thighs are supported along cushion length.

- Avoid pressure behind the knees.

Continued on page 53.

14 Loughborough University; *Driving Ergonomics: Initial driving position and posture guide*; **www.lboro.ac.uk/departments/hu/drivingergonomics/downloads/initial driving position and posture guide.pdf**

Continued from page 52.

4. Adjust back rest so it provides continuous support along the length of the back and is in contact up to shoulder height.

» Avoid reclining the seat too far as this can cause excessive forward bending of the head and neck and you may feel yourself sliding forwards on the cushion.

5. Adjust the lumbar support to give even pressure along the back rest.

» Ensure lumbar support 'fits' your back, is comfortable with no pressure points or gaps.

6. Adjust steering wheel rearwards and downwards for ease of reach.

» Check for clearance for thighs / knees when using pedals.

» Ensure panel display is in full view and not obstructed.

7. Adjust the head restraint to ensure the risk of injury is reduced in the event of a car accident.

Repeat stages 1-7 and fine tune as necessary. ***Be aware*** that many cars will not allow you as much flexibility of driving posture as you may like.

Particular cars may cause you to adopt a 'coping' posture. For example, limited headroom forces a reclined posture, making reach to the steering wheel a problem. This leads to excessive forward bending of the head and neck and a 'slouched' posture.

Information

Manual Handling from a Motor Vehicle

Many HCWs transport materials (equipment, supplies, computers, etc.) in a vehicle as part of their regular job duties. Manual handling from a vehicle is a potential risk factor for MSIs and may incorporate factors such as high forces and awkward postures. Useful strategies to reduce the risk associated with manual handling from a vehicle include:

» Use safe postures when handling a load. Obtain training if you are unsure of recommended lifting postures.

» Organize the trunk so that items can be moved with minimal reaching.

» Get as close to the material as possible to decrease forces.

» Use wheeled carts or suitcases to minimize the forces required to move the load.

» Consider making two or more trips to decrease the weight of each load.

» Ask for assistance if another person is available to help.

» Check the carrying path to ensure there are no tripping hazards.

Radiation

Legislated Requirements

Radiation

If workers may be exposed to ionizing radiation, an employer must:

a. develop and implement safe work practices and procedures,

b. if practicable involve the workers in the development and implementation of the safe work practices and procedures, and

c. inform the workers of the potential hazards of ionizing radiation.

Alberta OHS Code, Part 20

Did you know?

Radiation is defined as the emission and movement of energy through space. Two types of radiation are commonly found in healthcare work – ionizing and non-ionizing radiation.

Ionizing radiation has sufficient energy to impact atoms of molecules, creating ions, which can cause molecular changes to body cells. The health effects of ionizing radiation depend on several factors, including the total amount of radiation absorbed, the time period, the dose rate and the particular organ exposed.

Ionizing radiation affects individuals by depositing energy in the body which can damage cells or change their chemical balance. In most cases, exposure to ionizing radiation may not result in any adverse health effects. In other cases, the irradiated cell may survive but become abnormal, temporarily or permanently, and eventually may be cancerous.[15]

15 Occupational Safety and Health Administration; *Federal Registers: Occupational Exposure to Ionizing Radiation* 70:22828 – 22835; **www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=18341**

Non-ionizing radiation occurs at lower energy levels. Non-ionizing radiation does not have enough energy to disrupt the structure of atoms or molecules. However, it may have biological effects such as heating or initiating photochemical reactions.

Non-ionizing radiation includes ultraviolet light, visible light, infrared light, microwaves, radio waves and electricity. It causes damage based on the wavelength of the radiation, with effects including heating, skin burns, and eye damage. Examples of non-ionizing radiation found in healthcare include lasers, ultrasound, ultraviolet radiation, radiofrequency and microwave radiation. Magnetic fields used in some devices (e.g. MRIs) can cause serious incidents to patients and workers by pulling ferromagnetic items into the bore of the magnet.

Did you know?

Radiation is mentioned briefly in Part 20 of the Alberta OHS Code. Comprehensive legislation relating to radiation protection is found in the Alberta *Radiation Protection Act* (R-2 RSA 2000) and the *Alberta Radiation Protection Regulation* (182/2003).

Information

Definitions

RADIATION: ionizing or non-ionizing radiation and includes ultrasound;

IONIZING RADIATION: electromagnetic energy, atomic particles or nuclear particles that are capable of ionizing atoms;

NON-IONIZING RADIATION: electromagnetic energy that is not capable of ionizing atoms, but that may cause photochemical, heating or other effects.

Radiation Protection Act R-2 RSA 2000

Legislated Requirements

The Alberta *Radiation Protection Act* specifies obligations of employers and workers with regards to radiation protection. These include:

» The general responsibility for all parties to take reasonable precautions to protect people from radiation exposure.

» The responsibility of the worker to use all protective devices and equipment and to wear protective clothing provided by the employer.

» The responsibility of the employer to inform workers of radiation hazards and controls.

Radiation Protection Act R-2 RSA 2000

Information

The *Radiation Protection Act* addresses the installation and maintenance of radiation equipment (X-ray and laser), inspections of this equipment and facilities, the required notifications of any overexposures, and quality assurance programs. The *Radiation Protection Regulation* establishes limits for exposure to ionizing and non-ionizing radiation, and requires radiation workers to notify their employers of their pregnancy. The *Regulation* also prohibits anyone under 18 from using ionizing radiation equipment except in certain circumstances, and describes Registration Certificate requirements. Part 3 of the *Regulation* describes protection measures for the use of radiation equipment.

Nuclear medicine and radiation oncology departments and researchers that use radioactive materials are governed by the *Nuclear Safety and Control Act (Canada)*. This Act is enforced by the Canadian Nuclear Commission (CNSC), which issues licenses for the possession of radioactive sources. These licenses set out the criteria for compliance with the Regulations made under the *Nuclear Safety and Control Act*:

» *General Nuclear Safety and Control Regulations.*

» *Radiation Protection Regulations.*

» *Nuclear Substances and Radiation Devices Regulations.*

These can be viewed at **www.nuclearsafety.gc.ca/eng/lawsregs/**.

Ionizing Radiation

Ionizing radiation is produced by radioactive decay (the rearrangement of atoms) or X-ray machines and particle accelerators. Depending upon the wavelength, frequency and energy of the radiation, it may penetrate the body to varying degrees.

The major types of ionizing radiation are alpha and beta particles and X-rays and gamma rays. Alpha and beta particles are slower moving than X-rays and gamma rays. Alpha particles cannot penetrate the skin, so do not pose a high external hazard, but if they gain access into the body through ingestion or inhalation, they may pose a serious health hazard. Beta particles can travel through the air and can penetrate the skin and may produce harmful effects if the worker is exposed externally or internally. Alpha and beta particles can carry different levels of energy. While one source of beta radiation may not be considered dangerous others can present a significant hazard. Gamma rays and X-rays can penetrate tissue and may result in damage. Effects of exposure to ionizing radiation may be short-term or long-term and depend on the type and dose of radiation. Effects can range from the reddening of skin to tissue damage of varying degrees, cancer and in extreme cases, death. Areas[16] in healthcare where ionizing radiation may be used are

- Diagnostic radiology.
- Nuclear medicine (diagnostic and therapeutic).
- Radiation oncology (external beam and implants).
- Laboratories (radioactive materials).
- Dental offices (diagnostic X-rays).
- Areas where radioactive materials are stored or discarded.

Assessment of ionizing radiation hazards

Exposure to ionizing radiation is assessed through the monitoring of individual worker exposures and the environment. Several different types of dosimeters can assess individual employee exposures. Thermoluminescent dosimeters (TLDs) and optically stimulated luminescence dosimeters (OSLs) are the most widely used. Both can measure X-rays as well as gamma and beta radiation. It should be noted that the effects of radiation doses are cumulative over time in organs or tissues. Wipe tests are often performed to determine the degree

16 James T. Tweedy; *Health Hazard Control and Safety Management;* Second Edition; CRC – Taylor & Francis; 2005; ISBN 1-57444-306-2.

of loose radioisotope contamination on surfaces. Wipe tests are performed on nuclear sealed sources as part of semi-annual leak tests, on shipment containers of any open source nuclear materials, and on work surfaces where open source nuclear materials have been handled. Contamination monitoring can be performed with a hand held meter as long as the probe can detect the target isotope at the action level set by the CNSC. This is common in laboratories or in nuclear medicine where radioactive materials are used.

Survey meters are used to conduct radiation protection surveys to identify where radiation is present and to quantify the exposure rate from various sources. There are specific types of survey meters available to measure the various types of radiation. Scalers are used to quantify the amount of radiation in a sample (such as an air sample or wipe sample). Scalers are usually set to measure the sample for a specified period of time. Radiation spectrometers assist the user in determining the types of radiation present by measuring the energy spectrum of the radiation.

Bioassays may also be used to monitor a worker's internal exposure to radiation. Urine samples are assessed for workers using tritium and thyroid monitoring is performed for workers using radioiodine.

Did you know?

All healthcare organizations must determine the appropriate type and methods of monitoring based on exposure criteria set forth in legislation. In Alberta, the Maximum Annual Dose Limits for ionizing radiation can be found in Schedule 1 of the *Alberta Radiation Protection Regulation*.

Non-ionizing Radiation

Non-ionizing radiation used in healthcare includes laser, magnetic resonance imaging (MRI), ultrasound, microwaves, and ultraviolet (UV) light.

Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is a diagnostic procedure that uses three types of magnetic fields to visualize physical and chemical properties of tissues in the body. These include a strong static magnetic field, a radiofrequency (RF) field, and a magnetic field gradient that is switched

on and off during the imaging procedure. MRI is used extensively in cancer diagnosis and monitoring of treatment, functional assessments of heart muscle for heart-attack patients, assessment of patients after a stroke, as well as mapping out brain function to improve brain surgery outcomes.

Major safety concerns associated with MRIs relate to the strength of the magnetic fields and the action of the magnets on ferromagnetic objects. Magnetic fields can pull ferromagnetic items into the machine's bore, causing injury or death to the patient as well as serious damage to the magnet and imaging equipment. The health effects of worker exposure to magnetic fields are currently under investigation, however workers wearing cardiac pacemakers may be at risk.

Resources

More information about MRI safety can be found at **www.mrisafety.com**.

Lasers

Lasers are widely used in healthcare for surgical and therapeutic procedures as well as patient positioning. Laser systems[17] produce a beam of monochromatic light in the ultraviolet, visible, or infrared regions of the electromagnetic spectrum in which all the waves are "in phase" and of the same frequency.

Did you know?

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation.

Healthcare organizations using lasers must comply with the CSA Standard CAN/CSA-Z386-08: *Laser Safety in Health Care Facilities,* when designing their laser systems and programs.

17 Herman Cember; *Introduction to Health Physics;* Pergamon Press; 1983; ISBN 0-08-030936-4

American National Standards Institute (ANSI) Laser Class and Hazards[18]

Laser Class	Types of hazards	Potential uses in healthcare
1	Exempt from radiation hazard controls; risk during normal use is very low.	Laser printers, bar code scanners, CD players, laboratory analytical equipment.
2	Emit energy in visible range; used for very short time periods; not considered a significant eye hazard as the blink reflex will prevent eye injury; usually too bright for human eye to view for long periods; repeated, deliberate exposure to the laser beam may be a chronic viewing hazard.	Laser pointers, spectrometry.
3R	The laser beam would not injure the eye if viewed for only momentary periods, but may present a greater hazard if viewed directly with an optical instrument; probability of an actual injury is small.	
3B	Can produce an eye injury if viewed directly, both from intrabeam viewing and from specular (mirror like) reflections, but not usually from diffuse (matte) reflections; the blink reflex cannot protect the eye from injury; not generally a fire hazard.	Ophthalmology lasers, Physiotherapy lasers.
4	Can cause permanent eye damage from exposure to direct or diffuse beam viewing; burns to the skin and a potential fire hazard.	Most surgical lasers.

Ultrasound

Some examples of ultrasound use in healthcare include the use of ultrasound in motion detectors, cleaning baths, medical imaging, and for the destruction of kidney stones (lithotripsy). Hazards associated with ultrasound exposure include; nausea, headaches, tinnitus, pain, dizziness, and fatigue on exposure to audible high-frequency radiation above 10 kHz.[19] Temporary hearing loss and threshold shifts are also possible from high-frequency ultrasound radiation.

Low-frequency ultrasound radiation may produce local effects when a person touches parts of materials being processed by ultrasound. The hands are often involved in the area where ultrasound acts most strongly. Exposure to powerful sources of ultrasound may result in damage to peripheral nervous and vascular structures at contact points. The most commonly encountered health effects for sonographers do not relate to the ultrasound, but rather to biomechanical factors contributing to musculoskeletal injuries.

18 James T. Tweedy; *Health Hazard Control and Safety Management;* Second Edition; CRC – Taylor & Francis; 2005; ISBN 1-57444-306-2.

19 National Institute for Occupational Safety and Health; *Guidelines for Protecting the Safety and Health of the Health Care Worker;* **www.cdc.gov/niosh/docs/88-119/control.html**

Operator safety precautions to reduce occupational ultrasound exposure are provided in Health Canada's *Guidelines for the Safe Use of Diagnostic Ultrasound:* **www.hc-sc.gc.ca/ewh-semt/pubs/radiation/01hecs-secs255/index-eng.php**

Resources

Radiofrequency and Microwave Radiation

The major health effect identified with exposure to radiofrequency and microwave radiation is induced tissue heating. Microwave radiation is in the frequency range of 300 MHz to 300 GHz and causes absorption near the skin. Radiofrequency radiation is in the range of 3 kHz to 300 MHz and may be absorbed into deep body organs. Examples of healthcare equipment that use radiofrequency and microwave radiation include cell phones, microwave ovens, tissue processors, heat sealers, induction heaters, and microwave drying equipment.

Information on the effects of microwave radiation from the Ontario Ministry of Labour **http://www.labour.gov.on.ca/english/hs/pubs/radiation/index.php**

Information on maximum worker exposure limits for radiofrequency and microwave radiation at can be found in the Canada Safety Code 6 on the Health Canada website. **www.hc-sc.gc.ca/ewh-semt/pubs/radiation/index-eng.php#codes**

Resources

Ultraviolet Radiation

Ultraviolet (UV) radiation is used in dermatological procedures, phototherapy, curing processes for some materials in dental offices, fluorescence procedures in laboratories, and can be emitted from germicidal lamps (found in biological safety cabinets and in some ventilation systems). Exposure to UV radiation also occurs for workers exposed to sunlight, such as groundskeepers. Eye damage and burns to the affected areas of the skin may result from overexposure. Skin cancer is a well known effect of long-term exposure to UV radiation.

Resources

Information on occupational exposures to UV radiation, with maximum exposure limits, from the American Conference of Governmental Industrial Hygienists (ACGIH), CCOHS Publication "OSH Answers – Ultraviolet Radiation" at **www.ccohs.ca/oshanswers/phys_agents/ultravioletradiation.html**.

Controls for Radiation Hazards

Radiation protection is based on an approach to manage and control exposures to radiation workers and the general public to a level "as low as reasonably achievable" (ALARA), taking into account social and economic factors.

It makes sense...

Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable"

Judging reasonably achievable when implementing the ALARA principle

Understanding of the term "reasonably achievable" comes from the *Canadian Nuclear Safety Commission Regulatory Guide G-129 (2004)*: "Keeping Radiation Exposures and Doses 'as Low as Reasonably Achievable (ALARA)'". Though the term reasonably achievable has not been given definite meaning by the Canadian Court system, it is generally accepted in industry and by regulators to encompass the same considerations as the concept of "reasonably practicable". Utilization of ALARA fosters an overall health and safety approach to keep exposure as low as reasonably practicable / reasonably achievable through hazard assessment and control.

The ALARA principle is an international radiation protection concept that considers relevant social and economic factors and incorporates the notion that the magnitude of effort that should be applied to control doses depends on the magnitude of projected or historical doses. Employers are expected to reduce doses while minimizing the use of resources likely to have a poor return in safety improvement e.g. where individual occupational doses are unlikely to exceed 1 millisievert (mSv) per year, the public dose limit.

Continued on page 63.

Continued from page 62.

The *Canadian Nuclear Safety Commission Regulatory Guide* (2004) states "In implementing the ALARA principle, it must be determined whether the efforts to reduce doses are worthwhile. Some problems may be resolved using cost-benefit analysis or other quantitative techniques." The judgment of reasonableness is inherent in the ALARA process. The following help judge the reasonableness of an action:

Understanding – based on knowledge, experience and professional judgment.

Good Practice – considers the radiation safety practices and performance of similar operations.

Feasibility – approaches improvements in radiation protection pragmatically i.e. weighing cost versus benefits of implementing changes in accordance with their practical significance.

Information at: **www.cnsc-ccsn.gc.ca**

It makes sense...

The major strategies used for controlling ionizing radiation exposure are **Time, Distance and Shielding.**

» Minimize the time exposure could occur – reducing the worker's time where exposure could occur reduces the dose proportionally. For example, if you reduce the worker's time near the source from 4 hours to 2 hours, the worker's exposure is reduced by one-half.

» Maximize the distance from the source of radiation - increasing the distance reduces exposure according to the "inverse square law" where increasing the distance results in reducing the intensity by the square of the distance. For example, if you increase the distance from 3 feet to 6 feet (doubling it), you reduce the intensity of the exposure to one quarter the original exposure ($1/2^2$). The inverse square law does not apply to laser radiation. An "inverse cube law" applies to magnetic fields.

» Use the appropriate shielding material between the source and the worker – different types of material (depending upon the type and energy of radiation emitted) may be used to shield the source, reducing exposure.

Focus

The major strategies used to control radiation exposure are:

» Time

» Distance

» Shielding

Engineering Controls

Engineering controls are designed to reduce the hazard at the source.

1. Elimination and substitution

For ionizing radiation, elimination is sometimes an option when considering radioimmunoassays in laboratories, which are increasingly replaced by enzyme immunoassays or fluorescent marker procedures. In some cases, short-lived isotopes can be substituted for isotopes with a longer half-life.

2. Shielding

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 type of shielding material required is determined by the type of radiation. Alpha particles can be stopped by paper or clothing; beta particles can be stopped with Plexiglas, while gamma and X-rays require denser materials (concrete, lead) to provide adequate shielding. Shielding may be permanently installed in a location, or may be erected temporarily for more infrequent use of 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. Shielding calculations should only be performed by individuals with current knowledge of structural shielding design and the acceptable methods of performing these calculations.

3. Design considerations

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.

4. 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.

5. Equipment selection and maintenance

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.

Administrative Controls

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 radiation and are trained in the safe work procedures necessary to prevent exposure.

1. Inspection and Registration of Radiation Equipment

Legislated Requirements

- No person shall install or operate designated radiation equipment unless a registration certificate has been issued by the Director (College of Physicians and Surgeons of Alberta).
- A registration certificate may be made subject to any restrictions deemed necessary for the protection of workers and the general public

Radiation Protection Act R-2 RSA 2000

In Alberta certain medical radiation emitting equipment requires registration with the College of Physicians and Surgeons of Alberta prior to clinical operation. "Designated" radiation equipment include:

- Diagnostic or therapeutic X-ray equipment.
- Particle accelerators.
- Cabinet X-ray equipment.
- Diffraction and analytical X-ray equipment.
- Class 3B and 4 lasers.

Resources

The basis for registration of equipment and devices is compliance with the appropriate Health Canada Safety Code, available at **www.hc-sc.gc.ca/ewh-semt/pubs/radiation/index-eng.php**, or the CSA Standard CAN/CSA-Z386-08: *Laser Safety in Health Care Facilities.*

2. Radiation Safety Program

A key administrative control is the development and implementation of a comprehensive radiation safety program, with a designated radiation safety officer. The purpose of the program is to ensure compliance to all radiation protection legislation, provide oversight to those using radiation, provide training and exposure monitoring, and ensure that equipment is properly registered and maintained. More details about roles and responsibilities in a radiation safety program can be found in Health Canada Safety Code 35: Safety Procedures for the Installation, Use and Control of X-ray Equipment in Large Medical Radiological Facilities[20]. When nuclear materials are being used the requirements for the radiation safety program are set by the Canadian Nuclear Safety Commission (CNSC).

A laser safety program is required for facilities with class 3B and 4 lasers and an individual with specific training must be designated as the laser safety officer.

20 Accessible at **www.hc-sc.gc.ca/ewh-semt/pubs/radiation/safety-code_35-securite/section-a1-eng.php**

3. Time

As one of the three key principles of radiation control, limiting the time workers may be exposed to radiation is an administrative control. The scheduling of workers to reduce individual exposure and reduce the number of workers required in an exposure area limits exposure time. Scheduling is an important administrative control for UV exposure as well as exposure to ionizing radiation.

4. Training

Worker education is a critical administrative responsibility. In order to install, maintain, repair or operate radiation equipment a worker must be adequately qualified, suitably trained and sufficiently experienced to perform the work safely. In some cases (such as in laboratories and nuclear medicine departments which must obtain CNSC licenses for using radioactive material), specific certification is required. Workers must be trained on the nature of the hazards they may be exposed to and the control measures that must be utilized to reduce exposure. Engineering, administrative and personal protective equipment controls should be covered in training. In addition, emergency response procedures, hazard reporting, and proper waste disposal must be addressed. There should be a mechanism to assess worker competency following training to ensure the effectiveness of the training.

5. Safe work procedures

Safe work procedures for working with radiation are established as part of a radiation safety program. The procedures are developed to protect both patients and workers. For workers, the procedures involve the use of all levels of control with an emphasis on the strategies to increase distance between the worker and the source, decrease time spent where exposure could occur and provide appropriate shielding or barriers to block exposure. The design of safe work procedures also incorporates information found in equipment instruction manuals.

6. Exposure monitoring

Where there is the potential for employee exposure to ionizing radiation, exposure monitoring must be part of the radiation safety program. The *Alberta Radiation Protection Regulation* requires exposure monitoring for workers who are working with ionizing radiation.

Legislated Requirements

Monitoring of worker ionizing radiation exposure

An employer shall ensure that

a. radiation workers who use or are exposed to the use of any ionizing radiation equipment described in subsection (2) are provided with and use an appropriate device, provided by a dosimetry service provider licensed by the Canadian Nuclear Safety Commission, to monitor their personal exposure to ionizing radiation,

b. the records obtained from the monitoring are kept for at least 5 years, and

c. the workers are informed of and have access to these records.

Alberta Radiation Protection Regulation, Part 1, Section 4

Long term effects from exposure to ionizing radiation are cumulative and may appear many years later. Health Canada's National Dose Registry will provide a worker's own dose history upon request. Also, employers and prospective employers can obtain a worker's dose history upon written consent of the individual. This information is available at **www.hc-sc.gc.ca/ewh-semt/occup-travail/radiation/regist/index-eng.php**.

The most common approach to exposure monitoring for ionizing radiation is the use of radiation dosimeters, which measure the individual's exposure. Types of ionizing radiation dosimeters include thermoluminescent dosimeters (TLDs) and pocket or ring dosimeters. Ring dosimeters are TLDs that are designed to wear on a finger to measure exposure to the hands. In healthcare facilities TLDs provide a quarterly (every 3 months) accumulation of radiation exposure. Pocket dosimeters use quartz fibers and provide a direct read-out so that workers working in high radiation areas may check their exposure as they perform their tasks and take corrective action when necessary.

Dosimetry for various forms of non-ionizing radiation is available but more complex in terms of operation and interpretation and is not widely used for worker exposure monitoring in healthcare.

7. Disposal procedures

Waste disposal is a critical component of a radiation safety program, particularly with regard to radioactive material. A radiation safety officer should be consulted on the appropriate disposal procedures. In many cases, radioactive waste is segregated by type and stored until it decays (loses radioactivity) sufficiently for disposal.

Personal Protective Equipment

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 inspection 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.

A special case occurs in nuclear medicine where workers may come into contact with patients who have been injected with radioactive material and are awaiting their diagnostic procedure. If possible the best practice is to schedule nuclear medicine procedures following all other exams or enough time prior to allow physical decay and excretion of the radioactive material. If scheduling restrictions are not possible e.g. due to the patient's medical condition the ALARA principle would indicate the provision of PPE to the worker, even though the radiation exposure from singular or even multiple nuclear medicine patients for a short period is very small.

More information about specific controls will be found in section 6 that identifies hazards and controls by functional area in healthcare.

Falling Hazards

Across Canada, falls in the workplace are a significant source of injury, pain and suffering as well as a source of economic loss, in some cases, even resulting in death. The majority of falls can be prevented. Data suggests that the majority of worker falls (approximately 85%) occur on the same level resulting from slips and trips while the minority is related to falls from a height. This section will review the causes of falls, legislative requirements and control strategies applicable to the healthcare work environment. In healthcare, workers may be exposed to fall hazards related to patient or client handling.

Legislated Requirements

The Alberta OHS Code addresses walkways, runways and ramps. An employer must ensure that the surface of a walkway, runway or ramp has sufficient traction to allow workers to move on it safely.

OHS Code, Part 8

Fall on Same Level

Slips

A slipping hazard exists when there is inadequate friction (or traction) between the footwear and the walking surface. Common examples of slipping hazards include wet floors (e.g. tub rooms), greasy floors (e.g. kitchens), icy surfaces (e.g. parking lots), loose or unanchored rugs and floor surfaces with a smooth or waxed finish.

Trips

Trips occur when the worker's forward moving leg suddenly and unexpectedly stops. The body continues in its forward motion but the foot has not moved forward which causes the worker to unbalance and potentially fall. Sources of tripping hazards include uneven walking surfaces, equipment left in corridors, cables, cords, and an open bottom drawer on a filing cabinet. Factors that exacerbate the risk of tripping include inadequate lighting, obstructed view and rushing.

Falls from Height

Falls from height are related to climbing above the floor level through the use of ladders (portable, fixed), stools and other equipment. Falls can result in very serious and debilitating injuries. Falls from as little as one meter have resulted

in workplace fatalities. Falls from height are often related to the use of ladders but are also related to common workplace factors such as stairs. People lose their balance, slip on poor slip resistant material on the nose of the stair or neglect to use handrails, perhaps because they are carrying something.

Causes of Slips, Trips and Falls

Slips and trips can happen for a variety of reasons and the identification of the causes of a fall is essential to controlling the falling hazard. Causes may be related to a variety of factors including cleaning, flooring, people, contamination, obstacles, environment and footwear.

Resources

Slip and Trip Potential Model from the Health and Safety Executive of the UK Government; What Causes Slips and Trips **www.hse.gov.uk/slips/causes.htm.**

Causes of Falls from Ladders

Information

Summary of the causes and controls for falls from ladders from the Health and Safety Executive of the Government of the United Kingdom[21]

Common Causes of Falls	Prevention Strategies
The user over-reaches	» Keep your body centered within the ladder. » Always maintain three points of contact with the ladder.
The user slips from the ladder	» Keep the rungs clean and in good condition. » Wear non-slip footwear, if necessary, clean the soles before using a ladder. » Train workers to safely use a ladder. » Always maintain three points of contact with the ladder. » Make sure the rungs are horizontal.
The ladder wobbles, slips and falls	» Position the ladder correctly on a firm, level surface. » Inspect the ladder before use (including the condition of the feet). » Fasten the ladder at top and bottom. » Rest the ladder on a firm surface at the top.
The ladder breaks	» Position the ladder properly, using the 1 in 4 rule for leaning ladders (1 meter out for every 4 meters in height). » Do not exceed the maximum weight limit on the ladder. » Only carry light materials or tools (up to 10 kg).

21 Government of the United Kingdom – Health and Safety Executive; *Using Ladders Safely*; March 3, 2009; **www.hse.gov.uk/falls/ladders.htm;** Reproduced under the terms of the Click-Use License.

Control of Slips, Trips and Falls

In order to prevent slips, trips and falls in healthcare, organizations should implement a multifaceted prevention program. A key prevention strategy is the installation of proper flooring, maintenance practices and appropriate cleaning and care. The immediate clean up of liquid and contamination on walking surfaces is essential in controlling the hazard as well as the use of signs to identify potentially slippery walking surfaces. The following lists expand on the essential strategies to prevent slips, trips and falls.

Considerations when selecting flooring

The following is a list of important factors to consider when selecting flooring:

- Performance factors in wet and dry conditions.
- Durability (important in high traffic areas).
- Abrasion resistance (how long the surface will retain its slip resistance).
- Maintenance and care procedures (per manufacturer's specifications, not to require waxing).
- Impact resistance (weight of heavy loads).
- Appearance (important but not as crucial as safety: most modern flooring will retain a good appearance if maintained properly).
- Life-cycle costs.
- Safety of patients, residents, workers and visitors.

Suggestions for the selection of footwear[22]

Educate healthcare workers regarding footwear selection factors:

- Footwear should be selected for the specific work environment and work activity.
- The selection of footwear for wet environments should be slip resistant and have a good tread pattern.
- Ideally, footwear should be tested in the work environment to assess suitability.
- Use footwear that has full heel and toe coverage and that does not have holes or other design features that may allow for contamination.
- It is important that sole tread patterns do not become clogged with contaminants in the work environment (e.g. food in kitchens). The soles of shoes should be cleaned regularly to ensure that the soles are free of contaminants.

22 Government of the United Kingdom – Health and Safety Executive; *HSE Information Sheet; Slips and Trips in the Health Services*; 09/03; **www.hse.gov.uk/pubns/hsis2.pdf**; Reproduced under the terms of the Click-Use License.

» In footwear selection, consider the material used to make the sole as well as the hardness of the sole. Generally, a soft soled shoe with a close-packed tread pattern will perform best in an indoor environment with wet surfaces.

» Vitally important in shoe selection is the comfort and durability of the shoe.

» Consider standards and safety requirements for footwear (e.g. CSA Standard Z195-02 or ASTM Standard F2413-05).

Addressing wet floor surfaces[23]

A system to prevent and control wet floor hazards includes the following:

» Put a spill plan in place for areas that are prone to moisture and spills. Use absorbent mats at entrances. Ensure appropriate spill cleanup equipment is available at key locations where sudden spills of food, beverages or bodily fluids are likely to occur.

» Perform major floor cleaning and maintenance during non peak hours.

» Post wet-floor signs wherever floors are being wet-mopped or refinished. Know the drying times of floor care products and leave signs up until dry.

» Educate and encourage workers to wear appropriate footwear with gripping soles.

» Conduct frequent inspections and informal tours of floor surfaces, worker habits and cleaning and maintenance procedures.

» Conduct initial and periodic testing of slip resistance using a portable slip meter.

Controlling falling hazards in stairways[24]

Fallings hazards in stairways can be minimized through the following strategies:

» 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.

23 Fisher, Kenneth, Whoops; *Safe health care facility floors are no accident;* Health Facilities Management; November 1996; pg 44-46.

24 Canadian Centre for Occupational Health and Safety; *OHS Answers – Stairways – Fall Prevention;* May 26, 2009; **www.ccohs.ca/oshanswers/safety_haz/stairs_fallprevention.html**

» 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.

» Implement a good housekeeping regimen. Ensure spills, wet spots and debris are cleaned up immediately.

» Train workers to utilize handrails.

» Train workers to avoid carrying bulky objects that block vision or objects that require two hands to carry.

» Provide adequate lighting in stairways (at least 50 lux).

» Use angular lighting and colour contrast to improve depth perception.

Other controls for falling hazards

» Design patient care areas and equipment layout to minimize cords and to accommodate equipment without creating tripping hazards.

» Design patient care areas with adequate space to accommodate portable equipment without creating tripping hazards.

» Provide adequate storage space to minimize equipment storage in hallways.

» Keep hallways clear of obstructions.

» Use cord covers over electrical cords, as necessary.

» Maintain and repair parking lot surfaces.

» Clear snow and ice from parking lots and walkways.

» Provide well designed stools with slip resistant surfaces and stable, strong base.

Controlling falling hazards in the home care environment[25]

Healthcare workers who travel to home environments should consider the following strategies to decrease the risk of falling:

» Check the outdoor walkways and the entrance to the home for tripping hazards (e.g. ice, snow, uneven surfaces, etc.).

» Wear appropriate footwear that has a good tread and won't slip.

» Keep shoes on while you work.

» Check the floor surface before walking on it. Identify trip hazards such as slippery or uneven surfaces.

25 WorkSafeBC; *Home and Community Health Worker Handbook*; 2006; **www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/community_health_workers.pdf**

» Rinse and dry floors after cleaning to remove any slippery residue from cleaning products.

» Check for worn or uneven carpets or vinyl tiles that are curling at the edges.

» Watch out for clutter in walkways and stairs, and suggest that items be stored in a safer place.

» Use handrails when climbing up and down stairs.

» Tuck electrical cords out of the way.

» Keep drawers closed.

» Carry loads in both hands to keep your balance, and look where you are going.

Focus

The home care work environment may present increased challenges when controlling hazards in a patient/client's home. The healthcare employer should develop policies to minimize the risk of injury to workers providing services in a home care environment. Workers should identify hazards and put appropriate controls in place, whenever possible.

Ladder Safety[26]

The following is a list of guidelines to safely use stepladders:

» Always face the stepladder treads when using a stepladder.

» Never use a stepladder for entry to or exit from another work area.

» Never lean to one side or overreach while using a stepladder.

» Unless permitted by the stepladder manufacturer, never use a stepladder as a support for a working platform as the ladder is too unstable.

» Unless permitted by the stepladder manufacturer, never work from the top two steps.

» Always visually inspect the ladder before each use.

» Always place a stepladder on a firm, flat surface.

» Do not place a stepladder on boxes or scaffolds to gain extra height.

» Always take care when positioning a stepladder in corridors or driveways where it could be hit by a person or vehicle. Set up suitable barriers where necessary.

» Set base on secure, even surface. Shim the base if necessary.

26 Alberta Government; *Occupational Health and Safety Code 2009 – Explanation Guide;* part 8 **www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_p08.pdf**

Fall Protection

Legislated Requirements

An employer must ensure that a worker is protected from falling at a temporary or permanent work area if a worker may fall

a. a vertical distance of 3 metres or more,

b. a vertical distance of less than 3 metres if there is an unusual possibility of injury, or

c. into or onto a hazardous substance or object, or through an opening in a work surface.

OHS Code, Part 9, Section 139

Example

Some examples of working at heights in the healthcare setting include:

» Window cleaning in an atrium.

» Accessing heating, ventilation and air conditioning systems on a roof.

» Maintaining light fixtures.

The simplest and most reliable way of preventing workers from falling from an elevated work area is to install guardrails at the perimeter of the work area. Guardrails must be of a certain height and strength to prevent workers stumbling over the top rail or the guardrail collapsing, as specified in the Alberta OHS Code Section 315. A guardrail is an example of an engineering control that eliminates the hazard of falling rather than merely controlling the hazard. Other examples of engineering controls for falling hazards include eliminating the need to work at height by positioning equipment, lighting, controls, valves, etc. in locations accessible from ground level or from a location where there is not a hazard of falling.

Cutting Hazards

Hazards Causing Cuts

Healthcare workers in many areas may sustain cuts and puncture wounds in the course of their work. Hazard assessments are useful in identifying tasks that have the potential for creating cuts and puncture wounds. Sharps injuries with contaminated instruments or tools can lead to exposure to infectious diseases (refer to Volume 2 of this series) but in this section, we consider the physical hazard.

Example

Cuts may occur in the course of many jobs in healthcare. Examples include:

- **Food Service –** knives.
- **Laundry –** sharp items left in laundry.
- **Central Sterilization/Processing –** instruments.
- **Maintenance –** equipment hazards.
- **Operating rooms –** handling and passing instruments, blades and sutures, glass from motor vehicle accident victims.
- **Materials Management –** opening boxes.
- **Pharmacy –** handling packaging.
- **Housekeeping –** handling garbage that may contain sharps, broken glass, etc.
- **Laboratories –** sharp instruments and handling glassware.
- **All areas –** handling paper, working with equipment with sharp edges, etc.

Legislated Requirements

Employers must provide safeguards for machinery or equipment that may cause injury. Any machine part, function or process that may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or other workers in the vicinity, the hazards must be eliminated or controlled.

The employer must install positive means to prevent equipment from starting up when a worker is feeding material into the equipment or a part of the worker's body is within the machine's danger zone.

OHS Code Parts 22 and Part 25

Controls to reduce cuts

Engineering Controls

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. blunt tip suture needles and other engineered sharps injury prevention devices).
- Isolation of the process.
- Machine guarding to prevent direct contact with moving parts.
- Area design to reduce likelihood of exposure (including sufficient room to work safely, designated locations for storage of knives and other sharp instruments, etc.).
- Safety utility knives.
- Safety cutters as bag and box openers.
- Interlock systems that prevent operation of equipment unless guards engaged.
- Automated process in laundries to avoid sharps injuries while sorting soiled laundry.
- Metal detectors to detect misplaced sharps, and
- Equipment selection and maintenance.

Administrative Controls

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.

PPE

PPE is available to reduce cuts. In choosing PPE, the dexterity required to do the task must be considered. When there is the potential for body contact with blades or other equipment that may cause cuts, protective clothing should be worn. 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. In some cases, full arm coverage is recommended. 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. Finger guards are also available for use in kitchens for some cutting tasks.

Temperature-related Hazards

Temperature-related hazards can produce a variety of injuries and illnesses to healthcare workers. Exposure to extreme heat and cold can be from the environment or be related to equipment or materials.

Legislated Requirements

Exposure to temperature-related hazards

Employers are required to assess and control hazards workers may be exposed to at the work site.

OHS Code Part 2

Exposure to Environmental Cold

Healthcare workers may be exposed to cold temperatures during the winter months if they work outdoors (e.g. grounds keepers, maintenance workers, etc.), are exposed to outdoor temperatures through open doors (e.g. receiving docks), or if they travel to various work locations (e.g. home care, community health, public health, emergency responders, transport, workers traveling between facilities). Workers who work in refrigerated areas for extended periods (some laboratory workers, food service workers) may also be affected.

Cold temperatures may be forecasted or may occur unexpectedly. In any case, workers who may be required to be outdoors must be protected from the effects of cold temperatures. Exposure to the cold can produce a variety of injuries including frostbite and hypothermia.

Information

Useful definitions for cold-related injuries[27]

FROSTNIP occurs when ear lobes, noses, cheeks, fingers, or toes are exposed to the cold and the top layers of the skin freeze. The skin of the affected area turns white and it may feel numb. The top layer of skin feels hard but the deeper tissue still feels normal (soft).

FROSTBITE is caused by exposure to extreme cold or by contact with extremely cold objects (e.g., metal). Frostbite occurs when tissue temperature falls below freezing (0°C), or when blood flow is obstructed under cold conditions. Blood vessels may be severely and permanently damaged, and blood circulation may stop in the affected tissue.

HYPOTHERMIA occurs when the body is unable to compensate for its heat loss and the body's core temperature starts to fall. As the body continues to cool, muscular weakness, an inability to think clearly, and drowsiness are experienced. This condition usually occurs when the body's internal or core temperature falls below 33°C. Additional symptoms include shivering coming to a stop, diminished consciousness and dilated pupils. When the core temperature reaches 27°C, coma (profound unconsciousness) sets in.

27 Alberta Government; *Best Practice – Working Safely in the Heat and Cold;* August 2009; **www.employment.alberta.ca/documents/WHS/WHS-PUB_gs006.pdf**

Assessing exposures to cold temperatures

Cold temperature exposure guidelines take into account the level of physical work being done, the air temperature, and the wind chill factor (the perceived temperature as a result of wind conditions) and identify the maximum work periods and number and frequency of breaks required based on these parameters.

Individual reactions to cold temperatures can be affected by taking certain drugs or medications. In particular, alcohol, nicotine, caffeine or medications that impair judgment may make a person more susceptible to cold temperatures. Certain medical conditions such as diabetes, heart, vascular and thyroid problems have also been shown to exacerbate the effects of cold conditions.

Other factors that impact how quickly a body loses heat are the quality and quantity of clothing, the amount of physical work being done, whether clothing or footwear is wet, and the amount of sunlight. Personal characteristics such as age and physical condition also impact reaction to the cold. Workers can become somewhat acclimatized to the cold.

Did you know?

To stay warm in cold environments, the body

» Shivers – moving muscles increases heat production, and

» Reduces blood flow to the skin and extremities (hands and feet) to reduce heat loss from the surface.

Resources

Alberta Government's *Best Practice – Working Safely in the Heat and Cold* available at **www.employment.alberta.ca/documents/WHS/WHS-PUB_gs006.pdf**

Alberta Guidelines recommend following American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values® (TLVs®) for exposure to the cold available for purchase at **www.acgih.org/home.htm**

ACGIH Guidelines are adopted in the Saskatchewan Labour's "Cold Condition Guideline for Outside Workers" available at **www.labour.gov.sk.ca/coldconditions**

Exposure to Environmental Heat

Healthcare workers who work or travel outdoors or who work around heat-generating equipment for extended periods of time may be exposed to heat-related injuries and illness. The issue of sunburn related to UV exposure was discussed in the section on non-ionizing radiation. Heat stress refers to the overall heat load on the body, and includes environmental heat and inner body heat production due to working hard. When heat stress becomes severe, it may lead to a variety of conditions.

Information

Useful definitions for heat stress

HEAT EDEMA is swelling which generally occurs among people who are not acclimatized to working in hot conditions.

HEAT RASHES are tiny red spots on the skin, which cause a prickling sensation.

HEAT CRAMPS are sharp pains in the muscles that may occur alone or be combined with one of the other heat stress disorders.

HEAT EXHAUSTION is caused by excessive loss of water and salt.

HEAT SYNCOPE is heat-induced giddiness and fainting induced by temporarily insufficient flow of blood to the brain while a person is standing.

HEAT STROKE AND HYPERPYREXIA (elevated body temperature) are the most serious types of heat illnesses. Signs of heat stroke include body temperature often greater than 41°C, and complete or partial loss of consciousness. The signs of heat hyperpyrexia are similar except that the skin remains moist.

Assessing exposures to heat

Heat exposure is approximated by measuring the Wet-Bulb Globe Temperature (WBGT) index that takes into account air temperature, radiant heat, air movement and humidity. Clothing types also factor in as an adjustment to the WBGT. TLVs are provided based on the physical demands of the work (light, moderate, heavy, very heavy) and the allocation of work (% work in a cycle of work – rest). TLVs include an "action level" below the TLV that signifies protective measures should be put in place as the WBGTs are approaching the limit of safe work exposure.

Other factors that impact heat exposure include quality and quantity of clothing, the amount of physical work being done, individual characteristics such as age and physical condition, as well as certain drugs and medication and certain predisposing illnesses.

Did you know?

To stay cool in hot environments, the body

» Perspires or sweats – evaporating sweat cools the body, and

» Increases blood flow to the skin – to speed up the loss of heat from the skin (radiate away the excess heat) if the outside air is cooler.

Controls for dealing with temperature-related hazards

Workers must be protected from environmental conditions that may expose them to excessive cold or heat. The hierarchy of controls must be used with hazards from exposures to heat and cold hazards.

Engineering Controls

Engineering controls for heat and cold include reducing the level of work required in hot or cold environments, changing location of the work, isolating the worker in temperature controlled enclosures (such as cabs), providing local heating or cooling (depending on the nature of the hazard) in the work area, providing a climate-controlled rest area, using insulating materials and shields as appropriate. For those working in walk-in refrigerators or freezers, the rooms must have a release handle on the inside.

Administrative Controls

Administrative controls for cold environments include allowing an adjustment period, work-rest schedules with rest periods in a warm area, scheduling of work for warmer periods of the day, reducing periods of physical inactivity, such as sitting for long periods of time and occupational health programs to identify medical conditions that may pre-dispose workers to exposure.

Administrative controls used in hot environments include acclimatization, scheduling of work (to times of day when there is less heat), work-rest schedules, reducing the physical demands on the worker by lowering the

pace or intensity of the work, altering the duration of work, rotating staff, providing water, using a buddy system to notice any signs of over-exposure, and worker education about the effects of heat and how to recognize symptoms of exposure.

PPE

For cold environments, PPE includes layers of clothing, mittens rather than gloves if possible, head and face covers, and insulated footwear. All PPE should be kept dry. Water repellent clothing is important for workers who may be exposed to cold and wet conditions such as first responders.

PPE for hot environments must take into account the work that is being done, the dexterity required, and the safety factors related to clothing and personal equipment. PPE may include protective clothing, clothing that exposes more skin for cooling (unless there are other safety concerns), and self-contained air conditioners or cooling packs or units.

Cryogenic Hazards

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.

Controls for working with cryogenic liquids

Engineering Controls

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.

Administrative Controls

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.

PPE

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).

Exposure to Hot Equipment or Materials

Burns

Burns are damage to various layers of skin and can be caused by a variety of workplace agents including heat, cold, chemicals, radiation, and electricity. In other sections of this module and in the previous Volume 3 – Chemical Hazards, burns related to exposure to chemicals, cold, radiation and electricity were discussed. In this section, heat-related burns will be covered.

Heat-related burns may occur during flash sterilization or through contact with hot surfaces, fire, or steam. Healthcare workers most likely to be exposed to heat-related burns are facility workers in food services, laundry, maintenance, laboratories, and central sterilization. Community, long term care and home care workers may also receive burns in the course of their work as well as first responders.

Classification system of burns by severity[28]

Degree	Affected Layer of Skin	Symptoms	Healing	Life Threatening
First-degree	Epidermal	Redness, swelling, white patches at site of injury.	10 days with little scarring.	No
Second-degree – superficial	Epidermal and upper portion of Dermal layer.	Red, moist, may blister, skin may peel; minimal nerve damage.	If not infected, heals in 10 days; minimal nerve damage.	No
Second-degree – deep	Epidermal and Dermal.	Like second-degree superficial but whiter appearance and less pain due to nerve damage.	If not infected heals in 10 days; more nerve damage.	No
Third-degree	Epidermal, dermal and subcutaneous tissue.	Hard, leather-like scabs, purple fluid and no sensation or pain at burn site.	Usually involves surgery to aid healing and prevent infection; can destroy blood vessels and nerves.	Yes, if burn is over a large area.
Fourth-, fifth-, and sixth-degrees	Epidermal, dermal, subcutaneous and tissues under subcutaneous layer (e.g., muscle, bone).		Surgery is required and long term therapy; depending on degree, skin, muscle, or bone is permanently damaged or lost.	Yes

General controls to prevent burns

The following controls are used to prevent burns.

Engineering Controls

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.

28 Oregon Department of Human Services, Public Health Division; *Burn Surveillance;* April 16, 2009; **www.oregon.gov**

Administrative Controls

Administrative controls include worker education, established safe work practices, assessment of work area to identify potential sources of burns, and equipment maintenance programs.

PPE

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. Pot holders and long oven mitts protect kitchen workers from oven burns or contact with hot surfaces.

Noise Hazards

Noise is one of the most common workplace hazards.[29] Exposure to high levels of noise can cause hearing loss. Noise-induced hearing loss can be temporary or permanent. Temporary hearing loss can result from short-term exposures to noise, with normal hearing returning after period of rest.[30] Permanent hearing loss can also result depending on the nature of the noise. Noise-induced hearing loss is preventable through controls that are aimed at reducing noise at the source, along the path and at the worker.

Example

Noise levels that exceed regulated exposure limits may be found in a number of healthcare areas or result from operation of noisy equipment. Examples include:

- Food service – dish rooms.
- Maintenance service rooms and power plants.
- Operation of power tools, including grounds keeping equipment.
- Laundry.
- Central processing.
- Printing departments.
- Helipads (staff involved in emergency air transport).

29 Alberta Government; *Workplace Health and Safety Bulletin: Noise at the Work Site;* November 2009; **www.employment.alberta.ca/documents/WHS/WHS-PUB_hs003.pdf**

30 Occupational Safety and Health Administration; *Hearing Conservation* OSHA 3074; 2002; **www.osha.gov/Publications/osha3074.pdf**

Assessing Noise Exposures

Noise in the workplace is measured and assessed using specific procedures and sound monitoring equipment.

Did you know?

Sound is measured in decibels using equipment capable of electronic filtering that simulates the human ear's response to noise (A weighting). The unit of measure is decibels – A weighted or dBA. The CSA Standard Z107.56-06 *Procedures for the Measurement of Occupational Noise Exposure* must be followed when measuring worker exposure to noise. The Standard outlines procedures for determining occupational noise exposures using specific sampling techniques and equipment.

Information

Sound and Occupational Exposure Limits

Exposure Limits (OELs) define a worker's maximum permitted daily exposure to noise without hearing protection. OELs take into consideration the loudness of the noise — measured in decibels (dBA) — and the duration of exposure to that noise — measured in hours per day. For more information: **www.employment.alberta.ca/documents/WHS/WHS-PUB_hs003.pdf.**

Sound measurement equipment may include:

- sound level meters for area
- spot measurement of noise,
- dosimeters that are worn by workers that record a worker's dose or exposure to noise over a sampling period, and
- octave band analyzers that are used for measuring sound frequencies for use in evaluation of engineering controls or in some cases selection of PPE.

Noise Exposure

An employer must ensure that a worker's exposure to noise does not exceed

a. the noise exposure limits in Schedule 3, Table 1, and

b. 85 dBA L_{ex}.

An employer must ensure that all reasonably practicable measures are used to reduce the noise to which workers are exposed in areas of the work site where workers may be present.

Occupational exposure limits for noise set out in Part 16 of the Code and Schedule 3, Table 1.

OHS Code, Part 16, Section 216

Legislated Requirements

L_{ex} refers to a worker's total noise exposure over his or her shift and corrected to an equivalent 8-hour exposure. Workers' exposures to noise over a work shift are not simple mathematical averages of time and the magnitude of noise. Sound level monitoring equipment must be capable of integrating noise levels over the monitoring duration for comparison to occupational exposure limits. Assessing noise exposures must be done by a competent person, using appropriate monitoring equipment and following the requirements set out in CSA Standard Z107.56-06 *Procedures for the Measurement of Occupational Noise Exposure*.

Hearing protection that is worn by workers must meet the requirements of CSA Standard Z94.2-02 *Hearing Protection Devices - Performance, Selection, Care, and Use* and be of the appropriate class and grade specified in the Code. All workers who wear hearing protection must be suitably trained in the use, care and limitations of hearing protection devices.

Controls for Noise Hazards

Engineering Controls

Reducing noise by design and other engineering controls can be very effective; in some cases eliminating the need for personal protective equipment and noise management programs. The hierarchy of hazard controls must be applied in the control of noise hazards for all worksites.

Legislated Requirements

Noise control design

An employer must ensure that a new work site, equipment, work processes or significant alterations and renovations are designed and constructed in such a way that the continuous noise levels generated are not more than 85 dBA or are as low as reasonably practicable.

OHS Code Part 16, Section 217

Focus

Four primary methods of controlling noise by engineering control methods are.[31]

SUBSTITUTION – replace noisy equipment, machinery or processes with quieter ones;

MODIFICATION – modify the way equipment operates so that it generates less noise. This may include installing a muffler, reducing equipment vibration by dampening or bracing, improved lubrication, balancing rotating parts or operating equipment at a lower speed. Alternatively, the area itself can be modified. Reverberation, for example, can be reduced by covering walls with sound absorbing materials;

ISOLATION – this may involve isolating workers from a noisy area by having them work in an enclosed room. Examples of this approach include:

a. segregating noisy areas with sound barriers and partitions;

b. isolating noisy equipment by placing it in an enclosure; and

c. using sound absorbent material and covers over noisy equipment; and

MAINTENANCE – malfunctioning or poorly maintained equipment generates more noise than properly maintained equipment. Noise control equipment must also be properly maintained to be effective.

31 Alberta Government; *Occupational Health and Safety Code 2009 – Explanation Guide;* **www.employment.alberta.ca/SFW/3969.html**

Engineering controls may require specialized expertise from professionals such as acoustical engineers. Workers who work with the equipment or process play an important role by providing input when considering engineering controls.

Administrative Controls

If workers are exposed to excess noise, a noise management program is required.

Legislated Requirements

Noise Management Program

If a noise exposure assessment confirms that workers are exposed to noise in excess of the occupational exposure limits, the employer must develop and implement a noise management program. The program must include the following seven components:

» Worker education,

» Measuring or monitoring worker exposure to noise,

» Posting warning signs in any work area where the noise level exceeds 85 dBA,

» Use of noise control methods,

» Selection, use and maintenance of hearing protection devices,

» Audiometric testing, and

» Annual program review.

OHS Code Part 16, Section 221

An effective program includes all elements above and employee participation in the program's development and implementation. The program must be reviewed annually to review trends and ensure that it remains effective at protecting workers' hearing. As with development of the program, workers play an important role in the review of the program. Some areas where workers can provide input include the use and effectiveness of controls and the selection of hearing protectors.

For work areas where noise levels exceed 85 dBA, signs must be placed at entrances to inform workers of the noise hazard and the requirement to use noise control methods, specifically by wearing hearing protection devices. Management must actively enforce the use of hearing protection.

Workers must be educated in the noise management program including the identification of noise sources, hazards presented by noise, control methods, their audiometric test results and the use, care and limitations of hearing protection. Education must be provided to workers upon hire and on an on-going basis.

Legislated Requirements

Audiometric testing

If workers are identified as being exposed to workplace noise over OELs, the employer must provide and pay for baseline and annual hearing or audiometric testing completed by an audiometric technician who works in conjunction with a health professional and advise workers of any abnormal shifts in their audiogram.

OHS Code Part 16

Audiometric testing serves to identify changes in workers' hearing and provides aggregate data that can be used to evaluate the effectiveness of the noise management program. Testing must be performed by an audiometric technician working in consultation with an audiologist, physician or occupational health nurse. Workers must be informed of their audiometric results and testing records must be retained. Audiometric testing may be performed onsite by means of a mobile testing facility or at a designated facility as long as the testing facilities meet legislative requirements.

Other forms of administrative controls include reducing the length of workers' exposure time to noise and rotating workers through areas where noise is present. Occupational exposure limits presented in the OHS Code permit workers to be exposed to higher levels of noise as their exposure duration decreases. For example, a worker may be exposed to 94 dBA of continuous noise for one hour without wearing hearing protection, as long as the worker is not exposed to noise for the remainder of the worker's shift. Although permitted, many employers choose not to follow this practice, but rather provide hearing protection for the worker for any period of their work shift in which continuous noise levels exceed 85 dBA. This is best practice in protecting workers' hearing and is supported by the National Institute for Occupational Safety and Health.[32]

32 National Institute for Occupational Safety and Health; *At-work Solutions for Noise - Hearing Conservation Program Evaluation Checklist;* June 30, 2009; **www.cdc.gov/niosh/topics/noise/hearingchecklist.html**

PPE

Hearing protection devices must be considered to reduce workers' exposure to noise when other control methods cannot control noise to acceptable levels. Properly fitted hearing protectors reduce noise from entering the workers' ears.

A variety of hearing protection devices are available to workers. Selection of a hearing protector that is best suited for a particular task is based on several factors including noise monitoring results, legislative requirements, other PPE that the worker may wear, fit of PPE, the environment, and worker comfort. Two primary types of hearing protection devices (HPDs) are ear plugs and ear muffs.

As with other forms of PPE, proper fitting of hearing protectors is important. A poorly fitting hearing protector will not provide the protection that may be necessary. For example, a style of earplugs will fit a population of workers with varying effectiveness due to the design of the plug and differences in the shape of each worker's ear canal. Proper fitting may be achieved through education and by offering different styles of hearing protectors. In recent years, some hearing protection manufacturers have developed quantitative methods to evaluate the fit of hearing protectors to address this issue.

Pressure Hazards

Pressure hazards are common in healthcare facilities. Pressure hazards exist with compressed gas cylinders and pressure vessels that are used for various building operation functions. Oxygen cylinders are routinely found in patient care areas, while a wide range of cylinders are needed for various procedures and for maintenance and operation of equipment and machinery. Pressure vessels are present in building maintenance areas and are necessary for routine building operations.

Failure, rupture, or leakage of compressed gas cylinders, pressure vessels, or their connections or fittings may result in catastrophic injury and damage. As compressed gas cylinders and pressure vessels contain gases or fluids under pressure, an uncontrolled release could result in explosion, fire, flying projectiles, suffocation and worker exposures to high levels of toxic substances.

Information

Definition

A pressure vessel means a vessel used for containing, storing, distributing, processing or otherwise handling an expansible fluid under pressure.

The Alberta Boilers Safety Association states pressure equipment is "any piece of equipment that can contain pressures higher than normal atmospheric pressure could be considered 'pressure equipment'. Under *Alberta's Safety Codes Act* and *Regulations,* 'pressure equipment' is defined in a more specific way, based on factors such as its intended purpose, size, and design pressure."[33]

Alberta Pressure Equipment Safety Regulation

Legislated Requirements

Compressed and liquefied gas cylinders

Employers are required to ensure that precautions are taken when handling compressed and liquefied gas cylinders.

Compressed or liquefied gas containers and systems must be protected against damage and dislodgement that could result in a fire or explosion. The manufacturer's specifications must always be followed for the safe use, handling, storage and transportation of compressed or liquefied gas containers.

Specific controls referred to by the legislation include the following:

» A cylinder of compressed flammable gas is not stored in the same room as a cylinder of compressed oxygen, unless the storage arrangements are in accordance with Part 3 of the Alberta Fire Code (1997),

» Compressed or liquefied gas cylinders are equipped with a valve protection cap if manufactured with a means of attachment, and

» Oxygen cylinders or valves, regulators or other fittings of the oxygen using apparatus or oxygen distributing system are kept free of oil and grease.

OHS Code, Part 10

33 Alberta Boilers Safety Association; *Frequently Asked Questions;* August 24, 2006; **www.absa.ca/UsersGroup/GeneralPublic/GeneralPublicConsumerFAQ.aspx**

Pressure Vessels

Safety requirements for pressure vessels are detailed in the *Alberta Safety Codes Act* and *Regulations*. The Alberta Boilers Safety Association (ABSA) is the regulatory authority that enforces pressure equipment safety requirements set out in the legislation. Owners are responsible for ensuring the safe operation and proper maintenance of pressure vessels.

Resources

An overview of owner's responsibilities is detailed in ABSA's *Safety Codes Act* Flow Chart available at: **www.absa.ca/Forms/AB-508 Safety Codes Act Flow Chart.pdf**

Controls for Pressure Hazards

Engineering Controls

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 meet manufacturers' requirements.

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 it 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. Metal racks and chains are preferable to fabric straps, which may burn and tear during a fire.

Maintenance workers may use torches that use compressed oxygen and fuel gases. For these applications flashback arrestors and backflow preventers must be installed on the system to prevent fires and explosions by stopping flames from entering into hoses and regulators and by preventing gases from flowing back into hose lines.

Resources

Engineering controls for pressure vessels are inherent in their design as each vessel must meet specific design requirements prescribed by the *Alberta Pressure Equipment Safety Regulation* Available at: **www.qp.alberta.ca/574.cfm?page=2006_049.cfm&leg_type=regs&isbncln=9780779734825**

Administrative Controls

Compressed gas cylinders must be handled, maintained and stored carefully to prevent cylinders from falling or a gas release. Proper transportation of cylinders must be considered whether it is 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.

Information

Basic safe practices when working with compressed gases[34]

- Read the Material Safety Data Sheets (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 another.
- 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.

Continued on page 97.

34 Canadian Centre for Occupational Health and Safety; OSH Answers – *How Do I Work Safely with Compressed Gases?;* July 8, 2008; **www.ccohs.ca/oshanswers/prevention/comp_gas.html**

Continued from page 96.

- 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.

Information

Pressure vessel use and maintenance is governed by the *Alberta Pressure Equipment Safety Regulation* which stipulates requirements for operation, inspection, maintenance, certification and other requirements. A competent individual, usually a power engineer, will be responsible for ensuring pressure vessel safety requirements are met.

PPE

Personal protective equipment should be selected based on the hazards presented by the substance under pressure. Consult Material Safety Data Sheets for the specific products that are used. General PPE requirements for compressed gas cylinders may include gloves if hands may be exposed to substances that may cause freezing and protective footwear protects the feet from a large cylinder that is inadvertently dropped.

Confined Spaces

Healthcare maintenance and physical plant employees are responsible to manage the equipment and facilities often associated with confined spaces. Healthcare employees may be required to enter a confined space to perform an inspection or maintenance task. Historically, confined spaces have been identified as high risk work environments as hazards are often concentrated and confined space entries have resulted in many preventable workplace fatalities. Examples of confined spaces in the healthcare setting include: boilers, pressure vessels, HVAC systems, etc.

Legislated Requirements

The Alberta OHS Code requires that employers develop a Confined Space Code of Practice when workers enter and work in confined spaces. The code of practice must be in writing and available to workers.

OHS Code, Part 5; *OHS Regulation,* Section 8

Legislated Requirements

Definitions

Confined space means a restricted space which may become hazardous to a worker entering it because of

a. an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity,

b. a condition or changing set of circumstances within the space that presents a potential for injury or illness, or

c. the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

Restricted space means an enclosed or partially enclosed space, not designed or intended for continuous human occupancy, that has a restricted, limited or impeded means of entry or exit because of its construction.

OHS Code, Part 1

For practical purposes, a restricted space is a work area in which the only hazard is the difficulty getting into and out of the space as all other hazards have been eliminated or controlled. It is essential to remember that a restricted space may become a confined space if new hazards develop as a result of changes in the work environment or work procedures.

Example

Restricted spaces and confined spaces that may be found in healthcare.

1. A concrete mechanical room pit, deep enough to impede or restrict the rescue of an injured worker, but free of any hazards to workers such as a fall hazard, accumulated liquids or a hazardous atmosphere, is a restricted space. Suppose the base of the pit is actually a sump, designed to accumulate hazardous wastewater or chemical liquids. The location is now a confined space.
2. A dry crawlspace, enclosed in concrete and restricts movement under the ground level of a facility, but free of any hazards to workers such as accumulated liquids or a hazardous atmosphere, is a restricted space. If the concrete is cracked and occasionally leaks, or there is no concrete base and the exposed soil of the crawlspace is subject to springtime runoff from outside the building, moisture and mould can present itself. The potential for flooding due to water infiltration and the presence of potentially harmful mould would make this a confined space.

Hazards Associated with Confined Space Entry

Confined spaces present a variety of potential hazards that must be identified, assessed and controlled prior to any worker entering a confined space. Hazards associated with confined space entry fall into four general categories: atmospheric, safety, work task related and human factors.

Code of Practice

A code of practice is a document that describes the procedures and practices to be followed by workers to ensure work is safely performed in a confined space. The code must be in writing and readily available to the workers who are affected by it. Ideally, the code is also developed with input from workers who perform confined space entries and have firsthand knowledge of the hazards and best work practices and procedures to safely perform work in a confined space.

Focus

Developing a Code of Practice

Three basic steps to develop a code of practice for confined space entry:

1. Identify confined spaces at the work site.
2. Identify hazards in the confined spaces.
3. Develop a code of practice.

For more information refer to: Guideline for Developing a Code of Practice for Confined Space Entry; **www.employment.alberta.ca/documents/WHS/WHS-PUB_cs001.pdf**

Hazard Assessment of Confined Space

A hazard assessment must be performed on each confined space and restricted space before a worker can enter the space. The assessment is intended to identify all potential hazards in the space and the appropriate controls for each hazard. The assessment should also consider the difficulties associated with providing an injured or ill worker in a confined space with first aid or extrication. The hazard assessments must be kept current and updated when changes occur.

Controls

The hazard controls applied to a specific confined space entry are based on the hazards identified in the hazard assessment process. The hazard controls are specific to the type of confined space being entered and the nature of the work tasks to be performed in the space.

Engineering Controls

The use of engineering controls is of vital importance in the control of hazards associated with confined space entries. The most common engineering controls applied to confined space entry include the following:

- Substitution or elimination of requirement to enter confined space.
- Redesign of facility, equipment or process to eliminate the requirement to enter the space.
- Ventilation, purging, inerting.
- Testing the atmosphere.

Administrative Controls

Administrative controls are an essential element of managing confined space entry hazards and the majority of these controls are mandated by Alberta legislation.

- Code of practice, including entry procedures.
- Entry permit system.
- Worker training.
- Recordkeeping.
- Emergency procedures.
- Communication procedures.
- Tending worker.
- Warning signs.
- Barricade entrance.
- Isolate the confined space (lockout and tag out of hazardous energy sources).

Personal Protective Equipment

The use of personal protective equipment during an entry into a confined space is very common and should be based on a hazard assessment of the specific confined space and tasks to be performed. A sample of possible PPE that may be necessary follows:

- Gloves.
- Coveralls.
- Foot protection.
- Respirator.
- Emergency extraction equipment (to allow attendant to rescue individuals without entering the confined space).
- Hearing protection.

For further information on confined spaces:
www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_p05.pdf

Resources

Electrical Hazards

A multitude of electrical equipment is used in healthcare. Failures in electrical equipment, misuse, inadequate repair and maintenance of electrical equipment and services can result is serious injury to patients and workers as well as equipment damage. Any worker who uses electrical equipment may be exposed to electrical hazards.

Focus

Electrical shock occurs when electricity travels through a person's body. Shock occurs when a person contacts[35]:

- Both wires of an electric circuit.
- One wire of an energized circuit and the ground.
- A metal part that has become energized and the ground.

The most common shock-related injuries are burns. Burns from shock can be of three types:

- **Electrical burns –** Resulting from heat generated by electric current flowing through tissues or bones.
- **Thermal burns –** Resulting from skin contacting hot surfaces of electrical components or equipment. Thermal burns can also result from clothing that catches fire as a result of an electric arc.
- **Arc or flash burns –** Resulting from very high temperatures produced from an electric arc or explosion.

Maintenance workers and biomedical technologists who repair and service electrical equipment can be at risk of serious and fatal electrical injuries. Electric arcs may result when electrical current jumps between gaps in conductors and the current passes through the air exposing workers to extremely high temperatures and pressure blasts. Whenever possible work should not be performed on energized equipment and precautions must always be taken to protect workers.

Did you know?

Most electrical accidents result from one of the following three factors:

- unsafe equipment or installation,
- unsafe environment, or
- unsafe work practices.

35 Occupational Safety and Health Administration; *Controlling Electric Hazards; OSHA 3075;* 2002; **www.osha.gov/Publications/osha3075.pdf**

Personal Protective Equipment

The employer must ensure that the worker who may be exposed to a flash fire or electrical equipment flashover wears flame resistant body protection and uses other protective equipment appropriate to the hazard including: foot, eye and head protection if electrical hazards are present.

A worker must ensure that clothing worn beneath flame resistant outerwear and against the skin is made of flame resistant fabrics or natural fibres that will not melt when exposed to heat.

OHS Code, Part 18 Section 232

Legislated Requirements

Definition

Hazardous energy is defined as electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or any other form of energy that could cause injury due to the unintended motion energizing, start-up, or release of such stored or residual energy in machinery, equipment, piping, pipelines, or process systems.

OHS Code Explanation Guide

Information

Managing Control of Hazardous Energy

The employer must ensure energy sources are isolated when machinery needs to be serviced, repaired, tested, adjusted or inspected. Hazardous energy is not limited to electrical energy alone but rather any form of energy that could injure a worker.

OHS Code, Part 15

Legislated Requirements

The employer must meet the requirements for isolating energy sources, verifying that energy sources are isolated, securing isolation, and returning equipment to operation. This is sometimes referred to as lockout.

Legislated Requirements

If machinery, equipment or powered mobile equipment is to be serviced, repaired, tested, adjusted or inspected, the employer is responsible to ensure that the work activity is performed safely. Specifically, work cannot be performed until the machinery, equipment or powered mobile equipment has come to a complete stop, except as permitted by subsection 212(2), and all sources of hazardous energy have been isolated by an energy isolating device and the device has been secured.

As an alternative, the machinery, equipment or powered mobile equipment can be otherwise rendered inoperative in a manner that would prevent its accidental activation. Rendered inoperative may involve removing vital parts, putting blocking in place, pinning, or other equally effective methods. The method must be equally effective to as the isolation of energy method referred to above.

OHS Code, Section 212(1) and
OHS Code Explanation Guide

The Canadian standard, CSA Z462-08 *Workplace Electrical Safety,* based on National Fire Protection Agency (NFPA) 70E describes safe work procedures, use of energy control systems, and personal protective equipment when working around hazardous electrical equipment. The CSA and NFPA Standards provide specific guidance on electrical safe work practices including arc flash hazards and controls. The Standards are industry standards and considered to be best practices.

Controls for Electrical Hazards

Did you know?

Static electricity

Static electricity may present a hazard in the workplace; the greatest danger is when flammable liquids are poured or transferred as static electricity may present a source of ignition. By bonding (creating an electrical connection) between two conductive containers and grounding, static charges can be controlled.

Engineering Controls

All electrical rooms and vaults must be guarded from unauthorized access. Warning signs must be placed on doors warning employees of the electrical dangers as well as only authorized workers are permitted in these rooms. Electrical services need to be guarded by means of locked enclosures and/or elevating them away from where workers can reach them.

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 engineering control is grounding of electrical equipment with an electrical path to earth (ground). Grounding provides some protection to equipment operators if there was 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 and 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 called double insulated.

Information

Double Insulated Electrical Cords or Tools

Double insulated electrical cords or tools have additional insulating considerations to prevent the housing of the device from becoming energized. Such a device will be labeled with the term "double insulated" or with a symbol comprised of a square box within another square box.

Double Insulated Symbol

Administrative Controls

Healthcare facilities should develop a written electrical safety program that addresses all aspects of electricity use. CSA Standard Z32 *Electrical Safety and Essential Electrical Systems in Health Care Facilities* outlines guidelines of an electrical safety program. Some elements of an electrical safety program include:

- Education of staff who operate equipment.
- Provisions for control of electrical equipment including equipment owned by patients.
- Inspection, testing and maintenance of electrical equipment in patient care areas.
- Design and management of electrical installations.

CSA Standard Z32 also addresses the use of extension cords and power bars in healthcare. Extension cords should not be permitted in patient care areas and power bars should be hospital grade and not used in series with an extension cord.

Extension cords are used in many applications and should only be used for temporarily supplying power. Extension cords are not to replace permanent wiring. Other 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.

Example

For workers who service or repair electrical equipment and installations, electrical accidents are largely preventable through safe work practices. Examples of these practices include the following:[36]

» De-energizing electric equipment before inspection or repair.

» Locking out and tagging (by each individual working on the equipment) any switch or fuse used to de-energize the equipment.

» Keeping electric tools properly maintained.

» Exercising caution when working near energized lines.

» Using appropriate protective equipment.

Written electrical safe work procedures and policies should be developed for electrical service and maintenance work. Hazard assessments should guide the development of work procedures to asses and control electrical hazards. Organizations should have clear policies that require electrical equipment to be de-energized or de-energized and locked out whenever possible prior to being worked on. For most situations, electrical equipment must be de-energized and locked out before it is worked on. However, in some circumstances it may not be possible to de-energize the electrical equipment.

Only qualified electricians and biomedical technologists who are trained in safe work procedures can repair or service electrical equipment. Electric voltage testers and multi-meters must only be used by these workers. Electrical hazards for qualified workers must be assessed to determine risk presented by the hazards as well as control methods.

Written control of hazardous energy (lockout) procedures must be in place outlining policies and procedures for isolating energy sources, verifying that energy sources are isolated, securing isolation, and returning equipment to operation. Lockout procedures are applicable to all forms of hazardous energy, including electrical energy. As a minimum the following steps are required for the control of hazardous energy.

36 Occupational Safety and Health Administration; *Controlling Electric Hazards; OSHA 3075;* 2002; **www.osha.gov/Publications/osha3075.pdf**

Securing energy sources can be achieved by an individual, group or complex group process. Workers must verify that that the hazardous energy sources have been effectively isolated. When verifying isolation of energy sources workers must verify that the equipment has been rendered inoperative, sometimes referred to as a "bump test". When returning equipment to service, all workers involved in the lockout must be accounted for, only workers who installed securing devices may remove them, and in restarting the equipment, workers must be informed of the start up and not be placed in danger by the equipment.

PPE

Workers performing work on energized electrical systems need to wear PPE to protect from electrical shock, burns and arcs. PPE is selected on the risk level that is presented by the electrical equipment that is worked on, voltage and the potential for arcs. CSA Standard Z462 provides detailed selection criteria for PPE including body, hand, head, face, eye, and hearing protection. PPE must be approved or certified by agencies as required by the OHS Code.

Eye protection should be worn by all workers who work on energized equipment to protect from burns and flying particles. Face shields must be worn, based on the risk level presented to workers to protect from burns and flying particles.

Centrifuge Hazards

Centrifugation is a procedure commonly used in laboratories to separate particles from liquids (such as cells in blood) or liquids of different densities. The centrifuge is an apparatus that enables forces (called "centrifugal forces") to be generated that provide faster separation of materials than would occur by gravity alone. These forces are extremely strong and are produced by rapidly turning rotors. Speeds vary and centrifuges are chosen for the required type of separation.

Rotors are the specimen holders that are placed inside centrifuges. Rotors can be fixed so that the specimen tubes are placed and maintained at a specific angle or they can be "swinging bucket" where the specimen containers (buckets) swing out to an almost horizontal position as the force is generated. The tubes holding specimens must be balanced as they are placed in the centrifuge to enable a smooth rotation during the acceleration of the rotor. If the centrifuge is not balanced properly, the centrifuge can malfunction, resulting in "catastrophic failure" damaging the centrifuge and causing damage to people and the laboratory. Ultracentrifuges are very high speed centrifuges in use in many laboratories. Proper balancing is critical for the safe use of ultracentrifuges. In addition, centrifuge components may deteriorate over time and the metal fatigue may lead to centrifuge malfunctions.

Focus

Good centrifuge practices

- Ensure all operators are trained in the safe use of the centrifuge. Review the manufacturer's manual.
- Use rotors that are designed for the centrifuge.
- Check all parts of the centrifuge, rotor and tubes for defects before use.
- Ensure tubes are capped and balanced properly.
- Keep the centrifuge lid closed until the rotor has stopped.
- Stay at the centrifuge until the maximum speed is reached.
- When there is a problem, stop the centrifuge immediately.
- Clean the centrifuge regularly and ensure that regular maintenance is done.
- For ultracentrifuges, keep a record of rotor use and ensure the rotor is not used past its expiration date (when metal fatigue may occur).

Controls for Centrifuge Hazards

Controls for preventing centrifuge incidents include engineering, administrative and PPE considerations.

Engineering Controls

Engineering controls include interlock systems that do not allow the centrifuge lid to be opened until the rotor has stopped, centrifuge design features such as latched lids, inner safety lids, viewing windows, safety shut-off switches, and imbalance sensors.

Administrative Controls

Worker education is a key administrative control. Safe operating procedures include pre-centrifugation, during centrifugation and post-centrifugation procedures that are consistent with the manufacturer's instructions. Emergency procedures must address incidents where the centrifuge is unbalanced as well as tube breakage and possible contamination of the centrifuge or its parts. Equipment selection and maintenance is critical for ensuring the centrifuge is appropriate for the needs of the laboratory and continues to function without problems. Keeping a log book for rotor use is necessary to track rotor fatigue for ultracentrifuge rotors.

PPE

PPE for centrifuge operators is based on the nature of the materials being centrifuged. Gloves are commonly used when handling specimens and rotors.

Vehicle Driving Hazards

In Alberta, every week, six people die and nearly 500 people are injured in traffic collisions.[37] Work-related fatalities due to motor vehicle incidents are a serious concern for workers in many industries in Alberta. Healthcare workers may be involved in driving as they commute to and from work or as part of their work function, such as patient transport and drivers, home care and community care providers, mental health workers, public health officers, etc. Traffic-related fatalities and injuries have a high social and economic cost and work-related incidents are a significant component of the overall picture. Healthcare workers and employers have an excellent opportunity to implement controls to decrease the risk of traffic collisions (both work related and non work related).

37 School of Public Health – University of Alberta and Alberta Public Health Association; Coalition for Cellphone-Free Driving: *Quick Facts about Cellphone Use While Driving;* n.d.; **http://acicr.ca/Upload/news-events/communications-education/the-coalition-for-cellphone-free-driving/quick-facts/QuickFacts.pdf**

Key Safe Driving Tips:

- Don't speed.
- Use your seat belt.
- Stop at stop signs.
- Adapt to weather conditions – decrease speed as necessary.
- Don't drink and drive or take illicit drugs.
- Keep your vehicle well maintained, according to manufacturer's requirements.
- Take a rest break when tired.
- Avoid distractions.
- Map out your route ahead of time. Check weather and road conditions, prior to leaving, and adjust your driving plans accordingly.

Information

The Alberta OHS Code includes legislative requirements for the use of personal vehicles for work purposes; licensing and mechanical inspection.

If a worker uses a personal vehicle for work purposes,

(a) an employer must ensure that the worker complies with section 256(1) by complying with the appropriate licensed driver requirements of provincial legislation, and

(b) the worker must ensure that the vehicle is maintained in sound mechanical condition.

The first requirement can be met if the employer verifies that the worker has the appropriate provincial driver's license required to operate the type of personal vehicle being used. The second requirement can be met if the worker follows the maintenance requirements of the vehicle manufacturer.

OHS Code, Part 19

Legislated Requirements

Focus

Personal communication devices and driving[38, 39, 40]

The use of personal communication devices, including cell phones, while driving is a major distraction that is common on our roads. Research supports the following:

» Cell phone use (hand-held or hands-free) increases the risk of traffic collisions 4 times.

» Using a cell phone while driving slows the driver's reaction time.

» Cell phone use increases the risk of rear-end collisions.

» Using a cell phone while driving reduces visual field attention.

» Cell phone conversations increase the probability of missing red lights.

Cell phone use is only one in a long list of potential distractions that should be managed for safe driving. Other hazardous distractions include texting, adjusting radios and iPods, eating, applying makeup, conversations with passengers, etc.

Controls

Engineering Controls

» **Purchasing Standards –** Employers should review and evaluate the safety features of all vehicles to be considered for use. When selecting new vehicles, collision-worthiness and overall safety rating should be part of the selection criteria. In addition to reducing the risk of injury or injury severity in the event of a collision, this approach also conveys to workers that driving safety is a company priority.

Administrative Controls

Healthcare employers should consider a workplace driving safety program that targets driving safety in the workplace as well as outside working hours. Key components of a driving safety program include senior management commitment and employee involvement, written policies and procedures, driver qualifications, driver agreements, incident reporting and investigation, vehicle maintenance and inspection, driver training and communication and work scheduling.[41]

38 Strayer et al.; "Profiles in Driver Distraction: Effects of Cell Phone Conversations on Younger and Older Drivers"; *Human Factors; 2004;* 46(4); 640-649.

39 Barkana et al,; "Visual Field Attention is Reduced by Concomitant Hands-free Conversation on a Cellular Telephone"; *American Journal of Ophthalmology; 2004;* 138(3); 347-353.

40 Strayer et al.; "Driven to Distraction: Dual-task Studies of Simulated Driving and Conversing on a Cellular Telephone"; *Psychological Science;* 2001; 12(6); 462-466.

41 United States Department of Labor - OSHA; *Steps to Workplace Driving Safety;* January 26, 2009; **blog.nationalsafetycompliance.com/2009/01/steps-to-workplace-driving-safety-part.html**

- **Senior Management Commitment and Employee Involvement –** Safe driving is a vital element of an effective occupational health and safety program and therefore warrants senior management support and commitment. Consider establishing a key senior manager as the leader of the safe driving program. Senior management is responsible to provide leadership, approve policies and allocate budget to create a safe driving culture. Encourage workers to participate in the safe driving program and to spread the safe driving information to family members and friends.
- **Written Policies and Procedures –** Develop a written policy expressing the organization's commitment to reducing the risk of workplace traffic collisions. Design a set of clear and comprehensive safe driving policies and procedures and communicate the policies to employees. Specific policy issues to consider include winter driving safety, driving in remote areas and working alone requirements.
- **Confirm Driver Qualifications –** Check the driving records of all employees who drive for work purposes (using a company or personal vehicle). Ensure that no worker is assigned to drive on the job if he or she does not have a valid driver's license that is appropriate to the type of vehicle being driven. Obtain driver's abstracts for all employees who drive on behalf of the organization and confirm that they have a valid license and screen for employees with poor driving records. Driver's abstracts should be reviewed periodically to ensure that drivers maintain good driving records. Clearly define performance standards as it relates to demerit points and driving violations that a driver can have before losing the privilege of driving for work and define re-training requirements.
- **Driver Agreements –** Develop a written driving agreement to be signed by each employee who drives on behalf of the company. The agreement acknowledges that the driver is aware of the organization's safe driving policies and procedures, driver performance expectations, vehicle maintenance and inspection requirements and the reporting of vehicle incidents and traffic violations. Consider reviewing and signing the driving agreement on an annual basis as a strategy to keep safe driving in the minds of all drivers. Employers may consider requiring drivers to provide periodic documentation of vehicle insurance.

- **Reporting Incidents and Traffic Violations –** Educate employees to report all motor vehicle incidents as well as traffic violations. Full investigations should be completed on motor vehicle incidents in an effort to identify the immediate and root causes. The goal is for the organization to learn from motor vehicle incidents and develop strategies to prevent future losses.
- **Maintenance and Inspection –** Establish a preventative maintenance and inspection program that meets manufacturers' specifications and industry standards. The program should be formally documented and records from vehicle maintenance and inspection should be retained and readily available in the event of a serious vehicle incident. Workers who operate personal vehicles on behalf of the organization should be educated regarding the Alberta OHS Code S290.1 requirement that the worker ensure that the "vehicle is maintained in sound mechanical condition".
- **Driver Training and Communication –** Provide driving safety training to new and existing employees as a strategy to improve safe driving habits and driver attitudes. Provide training to any workers who operate specialized motor vehicles. Consider practical, performance based training for new employees who will drive on behalf of the organization. Teach workers strategies to recognize and manage driver fatigue and in-vehicle distractions. Emphasize the link between driver safety at work and driver safety at home. Lessons learned on the job can help to increase the awareness of workers to safe driving outside of work hours.
- **Work Scheduling –** Develop work schedules and driving routes that allow workers to obey all speed limits. Consider fatigue as a risk factor.

Resources

In Alberta, a traffic safety program has been developed by the Alberta Motor Association - Mission Possible @ Work. This program can be implemented using local worker facilitators to present 9 topic areas at regularly scheduled safety or staff meetings. Available at: **www.ama.ab.ca/driver-education/Mission-Possible-Traffic-Safety-at-Work**

Other driving safety training programs are also available from Certifying Partners, Industry Associations and private companies.

Shift workers and the commute home[42]

If you work at night, the most dangerous part of your day is the drive home. There are three factors which make the early-morning commute hazardous for shift workers:

1. If you work at night, you generally get less sleep than daytime workers do.
2. You may have been awake longer. If you sleep until 2pm and get off work at 7am, you are driving after being up for 17 continuous hours (nearly twice as long as a daytime worker who drives home at 6pm).
3. Your circadian rhythm, or internal clock, makes it difficult for you to stay awake and alert between 2am and 6am.

Did you know?

Winter Driving

Winter driving in Alberta can be hazardous as a result of decreased visibility, poor road conditions and decreased vehicle performance. It is important to evaluate road conditions and consider not travelling if conditions are bad. The employer should develop a policy to guide workers and supervisors in evaluating driving conditions and determining when it is unsafe to drive. The use of winter tires is recommended to improve safety during winter driving conditions. General principles for winter driving include staying on main roads (as much as possible) and keeping the radio tuned to local stations with weather reports. A worker should consider turning back or seeking shelter if weather and road conditions become unsafe. If visibility becomes poor, a worker should find a place to safely pull over as soon as possible.

Travel routes should be planned ahead of time and working alone requirements should be addressed. As many HCW travel alone and in some cases, assistance may not be readily available, it is necessary to address working alone requirements under Alberta legislation (OHS Code Part 28). The working alone hazard must be assessed and an effective means of communication provided by the employer. It is essential to evaluate the effectiveness of communication devices (e.g. cell phones, radio) in your region and determine if other communication technology may be necessary (e.g. global positioning systems, satellite phones, etc.) in some cases. Working alone will be discussed in more detail in Volume 5 of the best practice series.

42 Workers' Compensation Board – Alberta; *Working Safely Behind the Wheel;* 2009; **www.wcb.ab.ca/pdfs/public/driving_safely.pdf**

Did you know?

Local Weather offices for Environment Canada provide recorded messages that include weather conditions and forecasts. The Alberta Motor Association also supplies daily road reports. You can access the AMA Road Report at 1-800-642-3810 or online at **www.ama.ab.ca**

Checklist

Winter emergency kit checklist[43]

Workers should prepare for potential emergencies by having a winter driving emergency kit in their vehicles. List of contents checklist:

- □ Ice scraper and brush
- □ Antifreeze
- □ Booster cables
- □ Lock de-icer
- □ Shovel
- □ Matches and a candle in a can
- □ Sand, salt or kitty litter
- □ Winter clothing and footwear
- □ High-energy snacks
- □ Flares

These items should always be in your car or the cab of your truck:

- □ Road maps
- □ Flash light
- □ First-aid kit
- □ Blanket

Keep your vehicle properly maintained for winter driving. Regularly check and maintain:

- □ Battery
- □ Belts
- □ Hoses
- □ Radiator
- □ Block heater
- □ Tires

Mechanical Hazards

In healthcare, a multitude of machines are necessary for building operation, support services and patient care functions. Healthcare workers who work with machinery or those workers who work in areas where machinery is operating may be exposed to significant hazards. Safeguarding control methods are necessary to protect workers from dangerous mechanical motions.

43 Workers' Compensation Board – Alberta; *Working Safely Behind the Wheel;* 2009; **www.wcb.ab.ca/pdfs/public/driving_safely.pdf**

Machinery may present hazards by dangerous mechanical motions arising from the operation of the machine and any moving parts used to power the machinery or its functions. Some examples of machinery in healthcare that require safeguarding can be found in:

Example

Food service areas – slicers and mixers.

Maintenance areas – motors, fans, woodworking equipment, grinders and powered tools.

Laundry – washers, dryers, and other machinery for processing or folding laundry items.

Definition

Safeguard means a guard, shield, guardrail, fence, gate, barrier, toe board, protective enclosure, safety net, handrail or other device (excluding PPE) designed to protect workers operating equipment or machinery.

OHS Code, Part 1

Safeguards

Legislated Requirements

An employer must provide safeguards if a worker may accidentally, or through the work process, come into contact with

- moving parts of machinery or equipment,
- points of machinery or equipment at which material is cut, shaped or bored,
- surfaces with temperatures that may cause skin to freeze, burn or blister,
- energized electrical cables,
- debris, material or objects thrown from machinery or equipment,

Continued on page 118.

Continued from page 117.

Legislated Requirements

» material being fed into or removed from process machinery or equipment,

» machinery or equipment that may be hazardous due to its operation, or

» any other hazard.

If a worker may be injured while feeding materials into cutting or shaping machinery, an employer must ensure the machine worker uses a push stick, push block or other similar means of feeding the material.

OHS Code, Part 22

Focus

Criteria for machine safeguarding[44]

Safeguards must provide effective protection from the hazards presented by the machinery but still allow workers to use the machine for its intended task. A good machine safeguard:

» Prevents employee contact with the hazard area during machine operation.

» Avoids creating additional hazards.

» Is secure, tamper-resistant, and durable.

» Avoids interfering with normal operation of the machine.

» Allows for safe lubrication and maintenance.

Controls for Mechanical Hazards

Engineering Controls

Safeguards prevent workers from contacting dangerous machine motions by means of a physical guard, distance, or other mechanism that stops the machine from operating when the worker attempts to access dangerous machine areas.

44 Occupational Safety and Health Administration; *Safeguarding Equipment and Protecting Employees from Amputations; OSHA 3170-02R;* 2007; **www.osha.gov/Publications/osha3170.pdf**

Guards, which are physical barriers that cover dangerous machine areas, are usually the preferred method of safeguarding. Guards must be durable enough to withstand conditions that are placed on them and must not be easily removed by operators. Generally, tools must be used to remove guards unless the machine is protected by other means.

Safeguarding devices are other means of engineering controls. Safeguarding devices stop a machine from operating if an operator attempts to access dangerous machine parts. Safeguarding devices can be of various types including laser or light curtains that sense a person's body or hands, or interlocks that automatically deactivate a machine when a guard is removed. Distance can also be used to protect workers from hazardous machine motions by locating the moving machinery parts a sufficient distance from a worker's normal reach.

The choice of guards, safeguarding devices or other methods of safeguarding is largely dependent on the nature and function of the machinery. New equipment that is brought into facilities should be equipped with adequate safeguards as its design and manufacture meets requirements of safety standards. However, older equipment may be in use in facilities that does not incorporate sufficient safeguards and this machinery may require additional safeguarding upgrades.

Administrative Controls

Written safe work procedures and policies for machinery should outline operator responsibilities, work practices, maintenance procedures, removal of guards and training requirements. For hazardous machinery, policies should also specify the requirements of workers' clothing to fit closely to the body and to prohibit jewellery and unrestrained long hair that can become entangled in machines, resulting in serious injury. Machinery must only be operated by trained and authorized users which management must enforce.

Machinery should be regularly inspected to identify potential conditions that could result in an equipment failure or conditions that could contribute to an injury. Where applicable, preventative maintenance must also be performed.

Machinery controls must be clearly identified. Signs that indicate that the removal of guards can result in an injury and to alert workers of machinery that starts automatically should be placed on machinery.

Repair of machinery or removal of guards when a machine is not protected with other safeguard devices requires isolation of hazardous energy sources and a control of hazardous energy (lockout) program must be in place. Information on lockout programs can be found in the section on electrical hazards.

PPE

PPE must be selected based on an assessment of the hazards arising from the operation and function of each piece of machinery. Where hazardous mechanical motions are present, loose clothing must not be worn and some PPE such as gloves can create additional hazards if they were to become entangled in moving machinery.

Resources

Sources of information on safeguards can be found at:

- OSHA's publication *Safeguarding Equipment and Protecting Employees from Amputations* available at **www.osha.gov/Publications/osha3170.pdf**
- OSHA's publication *A Guide for Protecting Workers from Woodworking Hazards* available at **www.osha.gov/Publications/osha3157.pdf**
- United States Department of Labor – Mine Safety and Health Administration's publication MHSA's *Guide to Equipment Guarding* available at **www.msha.gov/s&hinfo/equipguarding2004.pdf**
- OSHA's publication *Concepts and Techniques of Machine Safeguarding* available at **www.osha.gov/Publications/Mach_SafeGuard/toc.html**

Non-patient Lifting Device Hazards

A variety of lifting devices may be present in healthcare facilities and are predominantly used for building maintenance activities. These devices are typically in the form of overhead cranes and material hoists that are used in maintenance or power plant areas. Maintenance workers may also use ratchet lever hoists or come-a-longs that are portable lifting devices that are used to lift heavy equipment or materials.

Hoisting equipment that may be found in healthcare includes:

- **Floor operated overhead/monorail crane –** a crane that is controlled by an operator on the floor with a pendant or wireless controller.
- **Hoist –** a lifting device designed to lift and lower loads that may be powered by hand or electricity.
- **Ratchet lever hoists (come-a-longs) –** a portable lifting device that is powered by hand with a ratchet wheel.

Example

Floor operated overhead cranes may be found in large maintenance areas and are capable of lifting heavy equipment and materials. Overhead cranes vary in their capacity to lift loads and are typically electric powered. These cranes are often used for specific hoisting tasks and equipment. Hoists of varying types and styles may also be found in maintenance areas including electric and chain hoists.

To accommodate lifting of various materials, specific equipment is required to attach and secure the load that is being hoisted. This equipment is referred to as rigging. Examples of rigging components include slings, wire rope, hooks and other specific equipment.

Serious injury and damage can result if a load that is hoisted from a crane or hoist were to drop. Misuse of ratchet lever hoists can also result in injury including cuts, concussions, and fractures.

Legislated Requirements

Cranes, hoists and lifting devices

Part 6 of the OHS Code applies to lifting devices, including cranes and hoists, with a rated load capacity of 2,000 kilograms or more. Lifting devices with a rated load capacity of less than 2,000 kilograms must have the rated load capacity shown on the equipment. Parts 6 and 21 of the OHS Code contain specific information regarding crane and rigging requirements. Crane and hoist related criteria addressed in Part 6 include manufacturer, repair, identification, inspection, operator requirements, log books, procedures, lift calculations, and communications. Rigging criteria addressed in Part 21 include rigging ratings, inspection, use, and rejection criteria. Crane operators, workers who are responsible for properly rigging loads and employers need to be knowledgeable of the contents of the OHS Code that outline crane and rigging requirements for the specific equipment that is used at their worksites.

OHS Code, Part 6 and 21

Other standards also apply to cranes and rigging, such as CSA Standard CAN/CSA-B167-96 (R2007) *Safety Standard for Maintenance and Inspection of Overhead Cranes, Gantry Cranes, Monorails, Hoists and Trolleys* which are referenced in the Code.

Resources

For more information refer to: *Guidelines for Safety Training of Overhead Crane Operators and Supervisors* available at **www.employment.alberta.ca/documents/WHS/WHS-PUB_is009.pdf**

Controls for Lifting Device Hazards

Engineering Controls

Cranes and rigging components are manufactured and designed to meet safety standards and in some cases are certified by a professional engineer. Numerous engineering controls are built into cranes and rigging components by design and must not be overridden, deactivated or removed.

Administrative Controls

CSA Standard CAN/CSA-B167-96 (R2007) *Safety Standard for Maintenance and Inspection of Overhead Cranes, Gantry Cranes, Monorails, Hoists and Trolleys* specifies minimum requirements for inspection, testing and maintenance of overhead cranes. Cranes specified in the Standard must meet the requirements of the Standards.

Safe work practices for crane operation and rigging are crucial in performing safe lifts. The Construction Safety Association of Ontario[45] has identified that "The single most important precaution in rigging and hoisting is to determine load weight before attempting any lift". Work procedures and practices must clearly define responsibilities, training requirements and outline procedures for safe crane operation and rigging criteria.

Another important administrative control is inspection of cranes and rigging components. Inspections must be carried out to identify damage, wear and other conditions that could affect a safe lift. Several types of overhead crane inspections are required which vary in their frequency and inspection criteria. Any defects found during the inspections must be rectified by a qualified person. Rigging components must also be regularly inspected for wear and defects that could compromise rigging components. Typically, damaged or defective rigging components must be removed from service immediately and physically altered so they cannot be brought back into service.

Crane operators and workers who are responsible for rigging must be competent and their training must meet legislated requirements.

PPE

As hoisting involves lifting and lowering heavy loads, PPE to protect workers from impact injuries to the head and feet are necessary. Protective footwear that protects the workers' feet from impact hazards is necessary as is head protection (hard hats). Eye protection may also be required if there is a potential for debris falling from a load that is hoisted. All PPE must meet the requirements of the OHS Code and bear appropriate approval marks (e.g. CSA, etc.), if required by OHS legislation.

45 Construction Safety Association of Ontario; *Hoisting and Rigging Safety Manual;* January 2007; **www.csao.org/images/pfiles/4_M035.pdf**

Patient Handling Equipment

Patient lifting devices are widely recognized as effective in reducing the risk of injury to healthcare workers. This topic has been discussed extensively in the companion document the Alberta Government's *No Unsafe Lift Workbook*. However, the lifting devices themselves may pose hazards for healthcare workers. Broken lifts, devices that are inappropriate for the specific tasks, and improper use of the devices may result in healthcare worker injury.

To reduce the potential for workplace injuries related to patient lifting devices:

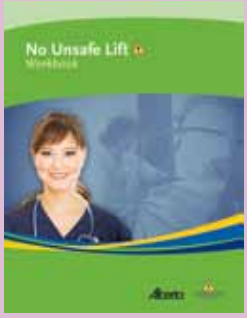
- Ensure the proper selection of devices based on clientele and transfer requirements.
- Include employee participation in the selection of devices.
- Ensure the availability of appropriate numbers and sizes of slings.
- Provide hands-on training for all HCWs expected to use the devices.
- Develop a preventive maintenance program.
- Ensure broken equipment is not used.

Checklist

Ontario's Workplace Safety and Insurance Board (WSIB) checklist for all employers with lifting devices.

How does your workplace stack up?

- □ Are procedures in place for the initial and regular inspection and servicing?
- □ Do operators conduct pre-use checks prior to daily operation?
- □ Are written job procedures available to, understood and followed by workers?
- □ Does a 'competent' person inspect, repair and maintain lifting devices?
- □ Is lifting equipment used properly by a trained and 'competent' person?
- □ Are supervisors trained and 'competent' regarding lifting devices?
- □ Are incidents and injuries investigated to find and eliminate the root causes?



For more detailed information regarding the selection and use of patient lifting devices, refer to the *No Unsafe Lift Workbook*.

www.employment.alberta.ca/ohs-healthcare

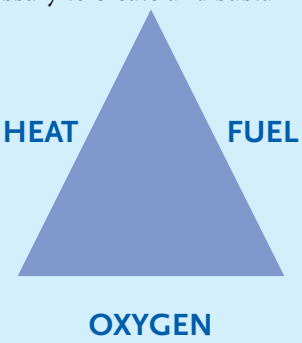
Focus

Fire / Explosion Hazards

Healthcare worksites contain many potential fire hazards. Most healthcare organizations have well developed fire prevention and response plans. Healthcare providers who work in leased spaces are usually involved in a building-wide fire response system, often managed by the property managers. In this section, we will not focus particular attention on individual functional areas, as every healthcare worker may be affected by fire. We will also not discuss details related to developing and implementing a comprehensive fire prevention and management program, as this is beyond the scope of this section.

Sources of fire hazards in healthcare include medical equipment, chemicals (flammables, combustibles and compressed gases), electrical hazards and appliances, paper products, furnishings, and building elements.

The "fire triangle" is often used to describe the three basic elements that are necessary to create and sustain a fire.



Did you know?

In healthcare, fire hazards pose a threat to patients, visitors, volunteers, contractors and staff. Most fire prevention and control programs have well developed protocols for identifying fires and detailed evacuation procedures. Facilities must comply with the Alberta Fire Code.

Resources

Alberta Government has a series of hospital-specific videos to assist in training staff about fire hazards and fire prevention. These are available on loan and can be found at **www.employment. alberta.ca/1883.html.**

Controlling the risk of fire

Engineering Controls

Engineering controls include a variety of fire prevention and fire suppression strategies. Fire detection and control equipment includes smoke or heat alarms, automated sprinkler systems, workplace design to ensure safe and effective egress, fire doors, emergency lighting, appropriate chemical storage, use of fire retardant materials, construction in compliance with the Alberta Fire Code and the Alberta Building Code.

Administrative Controls

Administrative controls are widely used to ensure the maintenance of fire equipment and effectiveness of the response plan. Major aspects of the fire prevention and response plan include:

- Employee training.
- Safe work procedures that minimize the potential for fires, including surgical fires.
- Building design considerations.

- Proper storage and use of chemicals and other materials, including bonding and grounding where required based on quantity and class of liquids.
- Ensure flammable chemicals are not used near an ignition source.
- Development of evacuation plans/routes.
- Designated roles and responsibilities in a fire response plan.
- Routine inspection for potential fire hazards.
- Availability and maintenance of fire response equipment, including the appropriate numbers and types of fire extinguishers.
- Availability and maintenance of alarm systems.
- Regular fire drills (including evaluation and identification of opportunities to improve).
- No smoking policy.
- Use of approved equipment and appliances only.
- Hot work permits.
- Contractor orientation to include fire hazard information and fire response plan.

According to the Alberta Fire Code, every building required by the Alberta Building Code to have a fire alarm system, every building where flammable or combustible liquids are stored, and every building containing "assembly or care or detention occupancy"[46] is required to have a Fire Safety Plan.

46 Alberta Fire Code; 2006; 2.8.1.1; Available for purchase at **www.municipalaffairs.gov.ab.ca/cp_fire_codes_standards.cfm**

Information

Components required in a Fire Safety Plan[47]

- Emergency procedures including: sounding the fire alarm, notifying the fire department, instructing occupants on procedures to be followed when the alarm sounds, evacuating occupants, including special provision for persons requiring assistance, and confining, controlling and extinguishing the fire.
- Appointment and organization of designated supervisory staff to carry out fire safety duties.
- Training of all staff in their responsibilities for fire safety.
- Documents and diagrams showing type, location and operation of fire emergency systems.
- Fire drills.
- Control/prevention of fire hazards.
- Inspection and maintenance of facilities provided for safety.

The frequency of fire drills is determined by considering the type of building and its occupancy, as well as features of the fire prevention system. Further information can be obtained in the Alberta Fire Code and in your facility Fire Safety Plan.

To minimize the physical hazard of fires, both engineering and administrative controls must be implemented. For community and home care workers, attention should be given to identifying and controlling fire hazards at the worksite. For those working in rented facilities, follow the fire safety plan for the facility and ensure that it includes provisions for evacuating patients and controlling the specific work environment.

47 Alberta Fire Code; 2006; 2.8.1.1; Available for purchase at **www.municipalaffairs.gov.ab.ca/cp_fire_codes_standards.cfm**

Section 6

Practices for the Control of Physical Hazards, by Functional Areas

Section 6: Practices for the Control of Physical Hazards, by Functional Areas

Physical hazards have been identified in many areas of healthcare facilities and in many tasks performed by HCWs. Each organization must systematically conduct hazard assessments for tasks performed by HCWs. In this section the most commonly encountered physical hazards and methods to control them in specific healthcare functional areas are presented. Employers should carefully evaluate the potential for exposure to hazards in all areas and ensure that they have an effective hazard control plan in place. This information will be useful for inclusion into hazard assessments. When considering physical hazards that workers may be exposed to, some workers who travel between sites, workplaces or work in community settings may be potentially exposed to a variety of physical hazards that they themselves may not be working with, but are present in the areas in which they work. These physical hazards must be included in the hazard assessment performed for these workers. Please note, this is not designed to be an exhaustive treatment of the subject, but is rather an overview summarizing the most frequently encountered physical hazards in healthcare settings.

General Notes:

The following charts provide basic information about control strategies for commonly occurring physical hazards. 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.

Direct Care – Medical Units

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of musculoskeletal injury (MSI) concerns. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Exposure to ionizing radiation through caring for patients who have received therapeutic amounts of radionuclides.	Provide private room with bathroom for patient. Precautionary covering of surfaces likely to be contaminated. Use water repellant surfaces. Seal surface seams.	Radiation safety program. Worker and patient education. Minimize time spent in close proximity to patient. Proper signage. Safe work practices (including proper handling of body substances, use of disposable items where possible, proper waste disposal, cleaning procedures, spill response procedures). Area monitoring as required. Emergency response procedures for medical emergencies.	Use of gloves and protective clothing as determined based on hazard assessment.

Direct Care – Medical Units Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to microwave radiation and heat through the use of microwave ovens.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments, including medical instruments.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Burns from handling hot equipment or materials.	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.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Operating Rooms and Surgical Units

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Biomechanical hazards associated with positioning and holding limbs, equipment, etc.	Ergonomically designed equipment to mechanically support limbs.	Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation.	

Direct Care – Operating Rooms and Surgical Units Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with awkward and sustained postures (e.g. prolonged standing and forward bent head/neck).	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 MSIs. Stretches and micro-breaks. Job rotation.	Appropriate footwear.
Exposure to ionizing radiation during interventional procedures.	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 e.g. procedures requiring fewer workers in area. Scheduling. Exposure monitoring program.	Lead gloves, aprons, etc. as required.
Exposure to laser beams during laser surgical procedures (usually class 4).	Ensure area has no reflective surfaces. Fail-safe systems. Lock/key access for activation, interlock systems. Opaque window covers. Local exhaust ventilation.	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. Signage. Laser safety program.	Gloves, gowns, and eye protection based on specific parameters of laser in use (wavelength, pulse versus continuous, wattage, laser class/type).
Exposure to microwave or radiofrequency radiation when performing diathermy surgery.	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.	
Falling hazards associated with slips, trips and falls.	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.

Direct Care – Operating Rooms and Surgical Units Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Cuts from passing instruments in operating theatres.	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.	
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Exposure to cryogenic agents in cryosurgical procedures.	Substitution (CO_2 instead of N_2O) 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.	Worker education. Safe work practices. Spill and exposure emergency response equipment and procedures. Oxygen depletion monitoring (depending upon hazard assessment).	Faceshields, goggles, insulated gloves, and protective clothing as required based on hazard assessment. Earplugs if venting gases.
Burns from handling recently heat-sterilized equipment.	Work process design to manage equipment turnover.	Safe work procedures. Rotation of supplies.	Heat-resistant gloves.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	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.	

Direct Care – Pre-hospital Emergency Responders

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with material handling of equipment, instruments and supplies including lifting, carrying, pushing, pulling, etc. Biomechanical hazards associated with awkward and sustained postures.	Ergonomically designed storage and interior space in ambulances, etc. Ergonomically designed equipment, instruments and containers.	Safe work procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed equipment, instruments and containers. Maintenance program for equipment, instruments and containers.	
Exposure to ionizing radiation through providing emergency response services for patients who have received therapeutic amounts of radionuclides.	Precautionary covering of surfaces likely to be contaminated.	Radiation safety program. Worker education. Minimize time spent in close proximity to patient. Safe work practices (including proper handling of body substances, use of disposable items where possible, proper waste disposal, cleaning procedures, spill response procedures). Area monitoring as required. Emergency response procedures for medical emergencies.	Use of gloves and protective clothing as determined based on hazard assessment.
Falling hazards associated with slips, trips and falls.	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.

Direct Care – Pre-hospital Emergency Responders Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Exposure to environmental heat from traveling outdoors.	Well maintained vehicles with adequate air conditioning.	Worker education about the effects of environmental heat exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to heat. Provision of water. Awareness of and job modification for workers with vulnerability to heat. Emergency response procedures/equipment for exposures.	Light-weight clothing if possible.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle (MV) collisions from driving vehicles, including ambulances.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Inspection and maintenance of vehicles. Work scheduling to prevent fatigue.	

Direct Care – Emergency Rooms

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 crash carts, carts, trolleys, etc.	Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. 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.	

Direct Care – Emergency Rooms Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to ionizing radiation through providing emergency services for patients who have received therapeutic amounts of radionuclides.	Precautionary covering of surfaces likely to be contaminated.	Radiation safety program. Worker education. Minimize time spent in close proximity to patient. Safe work practices (including proper handling of body substances, use of disposable items where possible, proper waste disposal, cleaning procedures, spill response procedures). Area monitoring as required. Emergency response procedures for medical emergencies.	Use of gloves and protective clothing as determined based on hazard assessment.
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	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.	

Direct Care – Long Term Care Patient Care

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	

Direct Care – Long Term Care Patient Care Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to microwave radiation and heat through the use of microwave ovens.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments, including medical instruments and scissors.	Elimination of sharps when not required. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Cuts from using shop or crafts equipment and tools.	Machine guarding. Interlock systems on equipment. Work area design.	Worker education. Authorized personnel only in area. Safe work procedures.	Cut-resistant gloves if appropriate. Eye protection.
Burns from handling hot equipment or materials.	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.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Electrical hazards arising from use of electrical cords and appliances.	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.	

Direct Care – Dialysis

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Falling hazards associated with slips, trips and falls.	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.

Direct Care – Dialysis Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Medical Oncology Units

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Exposure to ionizing radiation during therapeutic radiology.	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. Exposure monitoring program.	Lead gloves, aprons, etc. as required.
Exposure to ionizing radiation through administration of radioactive therapeutic agents.	Use of needlestick prevention devices. Shielding in the preparation, transport and administration of reagents, therapeutic agents. Use water repellant surfaces. Seal surface seams.	Radiation safety program. Worker education. Safe work procedures (proper labeling of all substances, proper disposal of all waste products, etc.) Reassignment of pregnant workers.	Gowns, gloves, and eye protection

Direct Care – Medical Oncology Units Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to ionizing radiation through caring for patients who have received therapeutic amounts of radionuclides.	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 substances, use of disposable items where possible, proper waste disposal, cleaning procedures, spill response procedures). Area monitoring as required. Emergency response procedures for medical emergencies.	Use of gloves and protective clothing as determined based on hazard assessment.
Exposure to microwave radiation and heat through the use of microwave ovens.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.
Falling hazards associated with slips, trips and falls.	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.

Direct Care – Patient Transport / Porters

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with material handling of equipment and furniture including lifting, carrying, pushing, pulling, etc.	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, stretchers, beds, trolleys, etc.	Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed equipment, furniture etc. Purchasing standards for material handling equipment. Maintenance program for equipment and furniture.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward posture) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Exposure to ionizing radiation through transporting of patients who have received therapeutic amounts of radionuclides.	Precautionary covering of surfaces likely to be contaminated.	Radiation safety program. Worker education. Minimize time spent in close proximity to patient. Safe work practices (including proper handling of body substances, use of disposable items where possible, proper waste disposal, cleaning procedures, spill response procedures). Area monitoring as required. Emergency response procedures for medical emergencies.	Use of gloves and protective clothing as determined based on hazard assessment.

Direct Care – Patient Transport / Porters Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Falling hazards associated with slips, trips and falls.	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.
Exposure to environmental heat from traveling outdoors.	Well maintained vehicles with adequate air conditioning.	Worker education about the effects of environmental heat exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to heat. Provision of water. Awareness of and job modification for workers with vulnerability to heat. Emergency response procedures/ equipment for exposures.	Light-weight clothing if possible.
Exposure to environmental cold from traveling outdoors.	Well maintained vehicles with adequate heating.	Worker education about the effects of environmental cold exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to cold. Awareness of and job modification for workers with vulnerability to cold. Emergency response procedures/equipment for exposures.	Multiple layers of clothing with inner layer of a "wicking" fabric, head cover, warm gloves (mittens if dexterity not required), warm and waterproof footwear, face protection as necessary.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles, including ambulances.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Inspection and maintenance of vehicles. Work scheduling to prevent fatigue.	

Direct Care – Orthopaedics – cast preparation

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with tool use and potential for awkward postures and high forces.	Ergonomically designed tools and equipment. Appropriate lighting.	Safe work procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed tools. Maintenance program for tools and equipment.	
Falling hazards associated with slips, trips and falls.	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.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Mechanical hazards from machinery operation.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs informing of guards.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Direct Care – Dental Offices or Dental Clinics in Healthcare Facilities or Community Care Settings

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with awkward sustained postures and repetition/duration.	Ergonomically designed workstations, chairs, instruments and equipment. Use automatic and ultrasonic instruments and tools whenever possible. Consider a nontraditional stool such as a saddle chair (improve posture and mobility). Minimize glare through the use of appropriate lighting and window coverings.	Adjust the workstation to the patient and the worker each time. Schedule patients in an effort to reduce risk factors. Worker education regarding biomechanical hazards and control strategies. Safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Alternate working position frequently. Keep frequently used instruments in easy reach. Purchasing standards for ergonomically designed workstations, chairs, instruments and equipment. Maintenance of equipment.	
Exposure to ionizing radiation when taking dental X-rays.	Workplace design to provide distance between worker and source. Appropriate shielding materials (permanent where possible). Interlock systems. Equipment design to minimize scatter. Positioning devices for patients. Audible signals on machines when exposure is ended.	Worker education. Safe work procedures reduce exposure time (procedures requiring fewer workers in area, etc.). Scheduling. Radiation safety program. Exposure monitoring.	Lead gloves, aprons, etc. as required.
Exposure to laser beams during dental procedures.	Ensure area has no reflective surfaces. Local exhaust ventilation. Fail-safe systems. Lock/key access for activation. Opaque window covers. Local exhaust ventilation.	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. Signage. Laser safety program.	Gloves, gowns, and eye protection based on specific parameters of laser in use (wavelength, pulse versus continuous, wattage, laser class/type).

Direct Care – Dental Offices or Dental Clinics in Healthcare Facilities or Community Care Settings Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to UV-A radiation when curing resin-based materials.	Equipment maintenance. Area design. Blue light filters.	Worker education. Safe work procedures including review and attention to equipment manufacturer's guidelines.	Eye protection with UV filters.
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	Gloves.
Exposure to cryogenic agents in cryosurgical procedures.	Substitution (CO_2 instead of N_2O) 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.	Worker education. Safe work practices. Spill and exposure emergency response equipment and procedures. Oxygen depletion monitoring (depending upon hazard assessment).	Faceshields, goggles, insulated gloves, and protective clothing as required based on hazard assessment. Earplugs if venting gases.
Burns from handling recently heat-sterilized equipment	Work process design to manage equipment turnover.	Safe work procedures. Rotation of supplies.	Heat-resistant gloves.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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.	
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Diagnostic Imaging/Nuclear Medicine

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment and materials including lifting, carrying, pushing, pulling, etc. Use of pinch grip to handle X-ray cassettes.	Ergonomically designed storage areas with adequate space. Ergonomically designed equipment and containers. Provision of appropriate materials handling equipment such as carts, stretchers, beds, trolleys, etc. Replacement of X-ray cassettes and developing X-ray film with digital technology.	Safe work procedures including proper lifting, pushing and pulling procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed equipment, containers etc. Purchasing standards for material handling equipment. Maintenance program for equipment.	

Direct Care – Diagnostic Imaging/Nuclear Medicine Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with positioning the X-ray tube including awkward postures and high forces.	Purchase X-ray equipment with mechanical assistance and remote controls to move the X-ray tube. Use automatic tables.	Safe work procedures should include moving the X-ray tube in a slow, steady rate. Lower the tube before moving it into position whenever possible. Maintain equipment to decrease forces required to move the X-ray tube and equipment. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks.	
Biomechanical hazards associated with the use of ultrasound transducer include repetitive movements, high duration, awkward and sustained postures and high forces. Potential for compression forces if worker rests elbow or forearm on hard surface while scanning. Awkward postures associated with the position of the monitor and keyboard.	Provide ergonomically designed ultrasound transducers (lightweight, appropriate size, balanced, slip resistant surface, and designed to allow a power grip with the wrist in a neutral posture). Provide a system to support transducer cables during the exam. Provide appropriate seating that incorporates armrests or cushions to support the arm while scanning. Consider alternative seating such as sit/stand seats or saddle seats. Provide adjustable exam tables.	Safe work procedures including proper ultrasound, lifting, pushing and pulling procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary work posture. Position patient and equipment to minimize biomechanical hazards. Purchasing standards for ergonomically designed ultrasound equipment, transducers, seating, etc. Maintenance program for equipment.	Select appropriate gloves that fit the worker comfortably and are textured and thin.
Exposure to ionizing radiation during diagnostic or therapeutic radiology.	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. Exposure monitoring program	Lead gloves, aprons, etc. as required.
Exposure to ionizing radiation through administration of radio-labeled diagnostic or therapeutic agents.	Use of needlestick prevention devices. Shielding in the preparation, transport and administration of reagents or therapeutic agents.	Radiation safety program. Worker education. Safe work procedures (proper labeling of all substances, proper disposal of all waste products, etc.). Radiation safety program.	Gowns, gloves, and eye protection.

Direct Care – Diagnostic Imaging/Nuclear Medicine Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to ultrasound.	Room design. Equipment maintenance.	Worker education. Limit number of workers in room. Safe work procedures (including placement and holding of applicator, operation of equipment to reduce exposure, etc.) Appropriate signage.	
Exposure to magnetic fields while performing Magnetic Resonance Imaging.	Workplace design. Isolation/ enclosure of worker. Interlock systems. Equipment maintenance.	Worker education. Pre-screening of patients for metal objects. Staff cannot wear / have implanted metal objects. Access limitations. Audible and visible warning signals.	
Falling hazards associated with slips, trips and falls.	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.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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.	
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Physical Therapy/Occupational Therapy/ Respiratory Therapy/ Recreation Therapy

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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, adjustable exam tables, etc.	Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. 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.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward posture) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	

Direct Care – Physical Therapy/Occupational Therapy/ Respiratory Therapy/ Recreation Therapy Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to microwave or radiofrequency radiation when performing diathermy treatments.	Proper maintenance of equipment. Workplace design to prevent scatter of radiation. Visible/audible sign that the equipment is operating. 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.	
Exposure to laser beams during laser therapy procedures.	Ensure area has no reflective surfaces. Fail-safe systems. Lock/key access for activation. Opaque window covers. Local exhaust ventilation.	Radiation safety program. Worker education. Safe work procedures (including placing laser in standby mode when not in use, single-operator activation, etc.). Signage. 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).
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Burns while providing diathermy.	Proper connection and handling of diathermy equipment.	Worker education. Safe work procedures including switching off equipment when not in use and appropriate signage.	
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Community Clinics, Doctors' Offices

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	Ergonomically designed storage areas with adequate space. Ergonomically designed equipment and furniture with appropriate casters and handles. Provision of appropriate material 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 MSIs. 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.	
Falling hazards associated with slips, trips and falls.	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.

Direct Care – Community Clinics, Doctors' Offices Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Exposure to cryogenic agents in cryosurgical procedures (dermatology, gynecology clinics)	Substitution (CO_2 instead of N_2O) 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.	Worker education. Safe work practices. Spill and exposure emergency response equipment and procedures. Oxygen depletion monitoring (depending upon hazard assessment).	Faceshields, goggles, insulated gloves, and protective clothing as required based on hazard assessment. Earplugs if venting gases.
Burns from handling recently heat-sterilized equipment.	Work process design to manage equipment turnover.	Safe work procedures. Sufficient number and rotation of supplies.	Heat-resistant gloves.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Ophthalmology and Dermatology Clinics

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Exposure to laser beams during laser surgical procedures (usually class 4).	Ensure area has no reflective surfaces. Local exhaust ventilation. Fail-safe systems. Lock/key access for activation.	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.). Signage. 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).
Falling hazards associated with slips, trips and falls.	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.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Direct Care – Home Care and Community Care Providers

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling when providing care in the home setting. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward posture) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	

Direct Care – Home Care and Community Care Providers Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to microwave radiation and heat through the use of microwave ovens.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.
Falling hazards associated with slips, trips and falls in client homes.		Safe work procedures for working in client homes. Train workers to check outdoor walkways and entrances for tripping hazards. Keep shoes on while working. Check indoor environment for tripping hazards and put controls in place (e.g. close drawers, tuck cords out of the way, etc.). Use handrails while climbing stairs. Carry loads in both hands to keep your balance, and look where you are going.	Appropriate footwear with gripping soles and good support.
Falling hazards associated with slips, trips and falls.	Install slip resistant flooring. Design stairwells according to accepted safety standards. Ensure adequate lighting.	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.
Cuts from sharp instruments, including medical instruments, household items, and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Cuts from broken glass or other sharp materials.	Racks and carts to carry breakable items.	Worker education. Safe work procedures including using dustpan and brush to pick up broken items, draining sink before removing broken glass.	Use of cut-resistant gloves or thick utility gloves.

Direct Care – Home Care and Community Care Providers Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to environmental heat from traveling outdoors.	Well maintained vehicles with adequate air conditioning.	Worker education about the effects of environmental heat exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to heat. Provision of water. Awareness of and job modification for workers with vulnerability to heat. Emergency response procedures/equipment for exposures.	Light-weight clothing if possible.
Exposure to environmental cold from traveling outdoors.	Well maintained vehicles with adequate heating.	Worker education about the effects of environmental cold exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to cold. Awareness of and job modification for workers with vulnerability to cold. Emergency response procedures/equipment for exposures.	Multiple layers of clothing with inner layer of a "wicking" fabric, head cover, warm gloves (mittens if dexterity not required), warm and water proof footwear, face protection as necessary.
Burns from handling hot equipment or materials in client homes.		Worker education. Safe work procedures including use of proper containers, safe handling procedures.	Insulated oven mitts.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Owner maintains and inspects vehicle. Work scheduling to prevent fatigue.	

Direct Care – Mental Health Workers

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with patient handling. Refer to the *No Unsafe Lift Workbook* at **www.employment.alberta.ca/ohs-healthcare.**	Availability of adequate sizes and types of patient handling equipment. Ergonomic criteria incorporated into facility design.	A comprehensive patient handling program that incorporates the principles of the *No Unsafe Lift Workbook*. Safe work procedures for patient handling activities. Worker education and awareness sessions. Risk assessment system for patient handling tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for patient handling equipment. Maintenance of patient handling equipment.	Appropriate footwear with gripping soles and good support.
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward posture) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	

Direct Care – Mental Health Workers Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Falling hazards associated with slips, trips and falls in client homes.		Safe work procedures for working in client homes. Train workers to check outdoor walkways and entrances for tripping hazards. Keep shoes on while working. Check indoor environment for tripping hazards and put controls in place (e.g. close drawers, tuck cords out of the way, etc.). Use handrails while climbing stairs. Carry loads in both hands to keep your balance, and look where you are going.	Appropriate footwear with gripping soles and good support.
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles, including ambulances.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Owner maintains and inspects vehicle. Work scheduling to prevent fatigue.	

Direct Care – Public Health Officers

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward posture) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Falling hazards associated with slips, trips and falls in the field.		Safe work procedures for working in client facilities. Train workers to check outdoor walkways and entrances for tripping hazards. Keep shoes on while working. Check indoor environment for tripping hazards and put controls in place (e.g. close drawers, tuck cords out of the way, etc.). Use handrails while climbing stairs. Carry loads in both hands to keep your balance, and look where you are going.	Appropriate footwear with gripping soles and good support.

Direct Care – Public Health Officers Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Falling hazards associated with slips, trips and falls.	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.
Noise from equipment and machinery in noisy work areas, or from operation of noisy machinery or tools.	Substitution with quieter equipment or processes. Alteration of machinery to reduce noise at the source or along path including modification, isolation and maintenance.	Noise management program. Worker training. Audiometric testing. Assess noise levels and perform routine exposure monitoring. Preventative maintenance program. Signs notifying of noisy areas.	Hearing protection devices.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles, including ambulances.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Owner maintains and inspects vehicle. Work scheduling to prevent fatigue.	
Mechanical hazards from machinery operation.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs informing of guards.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Support Services – Housekeeping

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Biomechanical hazards associated with housekeeping activities (e.g. bed making, room cleaning, using floor cleaning machines, handling garbage, etc.) including awkward postures, high forces and compression forces.	Provide ergonomically designed housekeeping equipment such as mops, polishers or floor scrubbers, housekeeping carts, etc. Design garbage disposal process to decrease handling of heavy bags and to decrease awkward positions (e.g. raise garbage takeout area above the ground level or use a chute). Lower drain levels so workers are not required to lift mop bucket. Replace handle grips on polishers and floor scrubbers with grips without ridges.	Purchasing standards for housekeeping equipment. Maintain equipment properly. Worker education regarding biomechanical hazards and control strategies and safe work procedures. Develop safe work procedures for key housekeeping tasks. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary work posture and tasks. Use portable casters to move furniture for mopping.	Kneepads or foam to allow workers to kneel on hard floors rather than squat. Vibration dampening gloves for polishers and floor scrubbers with high levels of vibration.

Support Services – Housekeeping Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to UV-C through the cleaning of UV lamps used as germicidal lamps found in microbiology laboratories and some biological safety cabinets.	Eliminate all non-essential use of UV lamps. Interlock systems on biological safety cabinets.	Worker education. Safe work procedures (including ensuring UV lamps are turned off before cleaning, etc.). Proper signage and warning when UV lamps are turned on.	Goggles with appropriate optical density to block UV rays when lamps are on.
Exposure to ionizing radiation through housekeeping tasks for rooms which contained patients who have received therapeutic amounts of radionuclides.	Precautionary covering of surfaces likely to be contaminated.	Radiation safety program. Worker and patient education. Safe work practices (including proper handling of body substances-contaminated items, proper waste disposal, cleaning procedures, and spill response procedures). Area monitoring as required.	Use of gloves and protective clothing as determined based on hazard assessment.
Falling hazards associated with slips, trips and falls.	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.
Cuts while emptying trash, picking up broken glass or other items.	Design of area and equipment for trash collection.	Worker education. Safe work procedures including proper techniques for picking up broken glass, removing trash bags, etc. Strictly enforced policies for sharps disposal.	Gloves of material sufficient for task (may include canvas or plastic-coated or reinforced gloves to provide better gripping. Goggles as required in hazard assessment.
Fire, projectiles, or physical injury if oxygen gas cylinders are damaged, dropped or mishandled.	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.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Support Services – Laundry

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of laundry, equipment, and supplies including lifting, handling, sorting, loading, unloading and folding.	Ergonomically designed equipment and materials such as laundry and linen bags. Reduce bag size. Taper bags to improve unloading and to limit size. Construct bag of slippery material, add handles. Consider an easy bag closure system. Design work areas and equipment to minimize reach distances. Use elevators. Reduce the capacity of laundry carts, etc. Consider sit-stand stools, anti-fatigue matting, foot rails or foot rests. Design work surfaces at an appropriate height. Provide work platforms to elevate smaller worker to an appropriate working height at fixed height work surfaces (e.g. folding table). Use mechanical folding devices.	Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed equipment and supplies. Maintenance program for equipment. Introduce job rotation and job enlargement. Break up demanding tasks such as folding over the shift among a number of workers. Examine work flow to minimize double handling of loads where practicable.	Provide well fitting protective gloves.

Support Services – Laundry Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to ionizing radiation through handling radiation-contaminated laundry.	Use disposable materials where possible.	Radiation safety program. Worker education. Hold contaminated linens in appropriate location for decay (under direction of radiation safety officer).	Use of gloves and protective clothing based on hazard assessment.
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp items left in laundry.	Automated sorting systems. Metal detectors.	Worker education. Strictly enforced policies for sharps disposal. Reduce handling of laundry as much as possible. Safe work procedures including keeping contaminated laundry bags away from body, proper sharps disposal for items found, etc.	Thick utility gloves (that can be decontaminated) for sorting contaminated laundry. Eye protection, protective clothing.
Mechanical hazards from machinery operation.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs informing of guards.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Support Services – Food Services

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling (lifting, pushing, pulling and carrying) of trays, food, supplies, meal service wagons, etc. including awkward and sustained postures, repetition and high forces.	Ergonomically designed storage areas with adequate space. Ergonomically designed equipment, carts and food service wagons with appropriate casters and handles. Design work areas and equipment (e.g. tray line) to minimize reach distances. Consider conveyers and rollers to move dishes to the dishwashing machine.	Safe work procedures including proper lifting, pushing and pulling procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation and job enlargement. Purchasing standards for ergonomically designed equipment, carts and wagons. Maintenance program for equipment, carts and wagons.	
Biomechanical hazards associated with the sustained standing posture.	Consider sit-stand stools, anti-fatigue matting, foot rails or foot rests, and the appropriate height of work surfaces. Provide work platforms to elevate smaller worker to an appropriate working height at fixed height work surfaces (e.g. tray line).	Safe work procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation and job enlargement.	
Exposure to microwave radiation and heat through the use of microwave ovens, heat sealers.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.

Support Services – Food Services Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Falling hazards associated with slips, trips and falls.	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.
Cuts from knives when preparing food.	Automated systems where possible. Slip-resistant flooring in cutting area. Design of storage area for knives (with blades not exposed). Trays for carrying knives. Hand guards.	Worker education. Safe work practices including using cutting board, cutting strokes away from body, washing knives separately.	Wire mesh gloves when possible.
Cuts from equipment when preparing food.	Machine guarding. Interlock systems to prevent use when guard is not engaged. Equipment choice and maintenance.	Worker education. Safe work procedures including using guards and glides, setting slicers back to zero after use, secure food in equipment properly before using equipment.	Cut-resistant gloves when cleaning the blades on equipment. Eye protection according to hazard assessment.
Cuts from broken glass.	Racks and carts to carry breakable items. Area design to avoid clutter.	Worker education. Safe work procedures including using dustpan and brush to pick up broken glass, draining sink before removing broken glass, proper storage of glassware.	Use of cut-resistant gloves.
Cuts from sharps left on food trays.	Automated systems.	Worker education. Strictly enforced policies for sharps disposal. Reduce handling of trays as much as possible. Safe work procedures. Proper sharps disposal for items found, etc.	Cut-resistant gloves.
Noise from equipment and machinery in noisy work areas, or from operation of noisy machinery or tools.	Substitution with quieter equipment or processes. Alteration of machinery to reduce noise at the source or along path including modification, isolation and maintenance.	Noise Management program. Worker training. Audiometric testing. Assess noise levels and perform routine exposure monitoring. Preventative maintenance program. Signs notifying of noisy areas.	Hearing protection devices.

Support Services – Food Services Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to cold temperatures when working in walk-in refrigerators or freezers; unpacking and stocking of cold/frozen products.	Door release on the inside of walk-in refrigerators and freezers. Use of refrigerators and freezers that avoid walk-in. Temperature monitoring equipment with warning alarms. Equipment maintenance.	Worker education. Safe work practices including efficient planning of work to avoid prolonged exposure to cold conditions. Work scheduling to reduce duration of exposure for any particular worker.	Insulated gloves, protective clothing and footwear as required for task and according to hazard assessment.
Burns related to contact with hot surfaces, hot products, or steam.	Warning alarms on equipment. Interlock systems to prevent opening equipment which is hot. Isolation/shielding of hot equipment. Equipment selection to reduce contact with hot surfaces (mechanized dish dryers, etc.) Programmable automatic shut-offs on equipment. Temperature and pressure relief valves.	Worker education. Safe work procedures including proper use and maintenance of all equipment, proper positioning when removing lids, etc. to reduce exposure. Lower temperature of hot water.	Heat-resistant gloves, eye protection, protective clothing and footwear as required based on hazard assessment.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Mechanical hazards from machinery operation.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs informing of guards.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Support Services – Security

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward posture) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Falling hazards associated with slips, trips and falls.	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.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Maintenance and inspection of vehicles. Work scheduling to prevent fatigue.	

Support Services – Laboratory/Autopsy

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with laboratory activities (pipetting, microscopy, microtome or cryostat, glove boxes, etc.) and autopsy including awkward and sustained postures, high forces, repetition, and compression forces.	Provide ergonomically designed equipment including pipettes, microscopes, microscope tables, chairs, footrests or foot rails, etc. Consider the use of automatic foot operated cryostat when frequent cryosectioning is performed. Ensure work surfaces are designed with a smooth, rounded edge to minimize compression forces. Provide anti-fatigue matting for standing work areas. Consider a sit-stand seat.	Develop safe work procedures for key lab activities. Worker education and awareness sessions. Arrange samples and instruments in easy reach. Each worker should use adjustable features to optimize his or her working posture. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation and job expansion. Purchasing standards for ergonomically designed instruments, equipment, chairs and work surfaces. Maintenance program for instruments, equipment, etc.	
Exposure to UV-C used in germicidal lamps found in microbiology laboratories and some biological safety cabinets.	Eliminate all non-essential use of UV lamps. Interlock systems on biological safety cabinets.	Worker education. Safe work procedures (including designated times to turn on the UV lamps, etc.). Proper signage and warning when UV lamps are turned on.	Goggles with appropriate optical density to block UV rays when lamps are on.
Exposure to ionizing radiation through the use of radio-isotopes for various assays/procedures.	Substitute process with an alternative that does not use radioisotopes (ELIZA, fluorescence, etc.). Use of short-lived isotopes. Use of fume hood. Shielding appropriate to nature of isotope.	Worker education. Radiation safety program. Designated Radiation Safety Officer (RSO). Safe work procedures including minimizing time of exposure, proper labeling, etc. Exposure monitoring. Medical monitoring with some isotopes (iodine). Proper waste disposal.	Gowns, gloves, eye protection.

Support Services – Laboratory/Autopsy Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to microwave radiation and heat through the use of microwave ovens to heat agar or other reagents.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.
Falling hazards associated with slips, trips and falls.	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.
Cuts from broken glassware, including capillary tubes and specimen vials.	Substitute with other materials (plastics). Change procedure to reduce use of capillary tubes. Proper type of glass for use in autoclaves. Use of centrifuge carriers with caps.	Worker education. Safe work procedures including removal of broken items from equipment (autoclaves, centrifuges, etc.), safe disposal of sharps, etc.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from sharp instruments including scalpels, scissors and medical instruments.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	Eye protection, protective clothing, and gloves as per hazard assessment.
Injuries from centrifuge malfunction.	Safety features of equipment including interlock system to prevent opening lid before rotor has stopped, safety switches, and imbalance sensors. Containment of centrifuge.	Worker education. Safe work procedures in keeping with manufacturer's instructions. Equipment maintenance. Proper tube selection and balancing of the centrifuge. Rotor logbook maintenance for high speed rotors.	Usually gloves. As required based on hazard assessment.
Exposure to cold temperatures when working in walk-in refrigerators or freezers.	Door release on the inside of walk-in refrigerators and freezers. Use of refrigerators and freezers that avoid walk-in. Temperature monitoring equipment with warning alarms. Equipment maintenance.	Worker education. Safe work practices including efficient planning of work to avoid prolonged exposure to cold conditions.	Insulated gloves, protective clothing and footwear as required for task and according to hazard assessment.

Support Services – Laboratory/Autopsy Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to cryogenic agents when freezing/thawing tissues or cells.	Use correct vials that have not expired. Proper equipment selection and maintenance. Proper storage of cryogenic containers that includes exhaust ventilation.	Worker education. Safe work procedures (including slowly introducing probes into cryogenic liquid, use in well ventilated area, positioning vials so that the vials are shielded when rapidly thawing.) Spill response and emergency exposure procedures.	Goggles, insulated gloves, protective clothing, protective footwear, faceshield depending upon hazard assessment.
Burns related to contact with hot surfaces (ovens, heating plates, burners, etc.) or products.	Warning alarms on equipment. Interlock systems to prevent opening equipment which is hot. Isolation/shielding of hot apparatus. Programmable automatic shut-offs on equipment.	Worker education. Safe work procedures including proper use and maintenance of all apparatus.	Heat-resistant gloves, eye protection, protective clothing and footwear as required based on hazard assessment.
Burns related to contact with steam from autoclaves.	Equipment maintenance, local exhaust (canopy) ventilation over autoclave door. Interlock system preventing opening of autoclave until specific temperature is reached. Proper autoclave carriers. Alarm systems on autoclaves.	Worker education. Safe work procedures, including proper loading and unloading of autoclave, loosening of caps before autoclaving, allowing sufficient standing time before removing items.	Heat-resistant gloves, rubber apron, and rubber sleeve protectors.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Mechanical hazards from machinery during autopsy.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs informing of guards.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Support Services – Research Laboratories

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with laboratory activities including awkward and sustained postures, high forces, repetition, and compression forces.	Provide ergonomically designed equipment including pipettes, microscopes, microscope tables, chairs, footrests or foot rails, etc. Ensure work surfaces are designed with a smooth, rounded edge to minimize compression forces. Provide anti-fatigue matting for standing work areas. Consider sit-stand seating.	Develop safe work procedures for key lab activities. Worker education and awareness sessions. Arrange samples and instruments in easy reach. Each worker should use adjustable features to optimize his or her working posture. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation and job expansion. Purchasing standards for ergonomically designed instruments, equipment, chairs and work surfaces. Maintenance program for instruments, equipment, etc.	
Exposure to ionizing radiation through the use of radio-isotopes for various procedures.	Use of fume hood. Shielding appropriate to nature of isotope.	Radiation safety program. Worker education. Safe work procedures (proper labeling of all substances, proper disposal of all waste products, etc.) Exposure monitoring. Medical monitoring with some isotopes (iodine).	Gowns, gloves, and eye protection.

Support Services – Research Laboratories Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to laser beams during laser research procedures (usually class 3B or 4).	Ensure area has no reflective surfaces. Fail-safe systems. Lock/key access for activation, interlock systems. Opaque window covers. Local exhaust ventilation.	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. Signage. Laser safety program.	Gloves, gowns, and eye protection based on specific parameters of laser in use (wavelength, pulse versus continuous, wattage, laser class/type).
Exposure to microwave radiation and heat through the use of microwave ovens to heat agar or other reagents.	Ensure proper maintenance of equipment (including periodic verification of any leaks). Interlock systems to ensure microwaves not generated when oven doors are open.	Worker education. Safe work procedures that incorporate ensuring the worker uses distance as a control measure.	Heat resistant gloves for removing items from the oven.
Falling hazards associated with slips, trips and falls.	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.
Cuts from broken glassware, including capillary tubes and specimen vials.	Substitute with other materials (plastics). Change procedure to reduce use of capillary tubes. Proper type of glass for use in autoclaves. Use of centrifuge carriers with caps.	Worker education. Safe work procedures including removal of broken items from equipment (autoclaves, centrifuges, etc.), safe disposal of sharps, etc.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from sharp instruments including scalpels, scissors and medical instruments.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from animal bites and scratches.	Restraining/immobilization devices. Design of work area.	Worker education. Buddy system for training and assisting. Safe work practices.	Eye protection, protective clothing, and gloves as per hazard assessment.
Injuries from centrifuge malfunction.	Safety features of equipment including interlock system to prevent opening lid before rotor has stopped, safety switches, imbalance sensors, containment of centrifuge.	Worker education. Safe work procedures in keeping with manufacturer's instructions. Equipment maintenance. Proper tube selection and balancing of the centrifuge. Rotor logbook maintenance for high speed rotors.	Usually gloves. As required based on hazard assessment.

Support Services – Research Laboratories Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to cold temperatures when working in walk-in refrigerators or freezers.	Door release on the inside of walk-in refrigerators and freezers. Use of refrigerators and freezers that avoid walk-in. Temperature monitoring equipment with warning alarms. Equipment maintenance.	Worker education. Safe work practices including efficient planning of work to avoid prolonged exposure to cold conditions.	Insulated gloves, protective clothing and footwear as required for task and according to hazard assessment.
Exposure to cryogenic agents when freezing/thawing tissues or cells.	Use correct vials that have not expired. Proper equipment selection and maintenance. Proper storage of cryogenic containers that includes exhaust ventilation.	Worker education. Safe work procedures (including slowly introducing probes into cryogenic liquid, use in well ventilated area, positioning vials so that the vials are shielded when rapidly thawing.) Spill response and emergency exposure procedures.	Goggles, insulated gloves, protective clothing, protective footwear, and faceshield depending upon hazard assessment.
Burns related to contact with hot surfaces (ovens, heating plates, burners, etc.) or products.	Warning alarms on equipment. Interlock systems to prevent opening equipment which is hot. Isolation/shielding of hot apparatus. Programmable automatic shut-offs on equipment.	Worker education. Safe work procedures including proper use and maintenance of all apparatus.	Heat-resistant gloves, eye protection, protective clothing and footwear as required based on hazard assessment.
Burns related to contact with steam from autoclaves.	Equipment maintenance, local exhaust (canopy) ventilation over autoclave door. Interlock system preventing opening of autoclave until specific temperature is reached. Proper autoclave carriers. Alarm systems on autoclaves.	Worker education. Safe work procedures, including proper loading and unloading of autoclave, loosening of caps before autoclaving, allowing sufficient standing time before removing items.	Heat-resistant gloves, rubber apron, rubber sleeve protectors.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Support Services – Central Processing

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with awkward and sustained postures, repetition and compression forces.	Design workstations so that packaging and equipment is in easy reach and elbows can be kept by the worker's side. Consider height adjustable work surfaces. Provide ergonomic carts with large and low resistance casters. Consider sit-stand stools, anti-fatigue matting, foot rails or foot rests, and the appropriate height of work surfaces. Ensure the edges of work surfaces are smooth and rounded to minimize compression forces.	Safe work procedures. Worker education and awareness sessions. Instruct workers to minimize sustained overhead reaching and to avoid leaning on hard sharp surfaces. Arrange packaging and equipment in easy reach. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation and job enlargement. Purchasing standards for ergonomically designed equipment, carts and wagons. Maintenance program for equipment and carts.	
Falling hazards associated with slips, trips and falls.	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.

Support Services – Central Processing Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Cuts from sharp instruments, including medical instruments and scissors.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	
Noise from equipment and machinery in noisy work areas, or from operation of noisy machinery or tools.	Substitution with quieter equipment or processes. Alteration of machinery to reduce noise at the source or along path including modification, isolation and maintenance.	Noise management program. Worker training. Audiometric testing. Assess noise levels and perform routine exposure monitoring. Preventative maintenance program. Signs notifying of noisy areas.	Hearing protection devices.
Exposure to environmental heat when working in hot indoor environments (autoclave/heat sterilizer rooms).	Equipment maintenance, portable ventilation devices.	Worker education about the effects of heat exposure. Communication system in case of emergency. Work-rest cycles. Work scheduling to avoid long periods of exposure to heat. Provision of water.	Light-weight clothing if possible.
Burns from handling recently heat-sterilized equipment.	Work process design to manage equipment turnover. Work area design. Automated processes.	Worker education. Safe work procedures.	Heat-resistant gloves. Protective clothing including arm protection as required by hazard assessment.
Burns related to contact with steam from autoclaves.	Equipment maintenance, local exhaust (canopy) ventilation over autoclave door. Interlock system preventing opening of autoclave until specific temperature is reached. Proper autoclave carriers. Alarm systems on autoclaves.	Worker education. Safe work procedures, including proper loading and unloading of autoclave, loosening of caps before autoclaving, allowing sufficient standing time before removing items.	Heat-resistant gloves, rubber apron, and rubber sleeve protectors.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Support Services – Pharmacy

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Job rotation and variation of tasks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with pharmacy activities including repetition, force, awkward postures and compression forces.	Ergonomically designed workstations to minimize reaching. Work surfaces of appropriate heights and adequate storage space. Ergonomically designed equipment and appropriate materials handling equipment such as carts, trolleys, etc. Replace manual with automated processes whenever practicable.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical hazards and control strategies. Safe work procedures for key pharmacy activities. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Job rotation and variation of tasks. Purchasing standards for ergonomically designed workstations, chairs and equipment. Maintenance of equipment.	
Exposure to radioactive material in the preparation, unit dosing and testing of radioactive diagnostic and therapeutic radiopharmaceuticals (nuclear pharmacy).	Leaded glass shielding. Leaded glass syringe shields and lead containers.	Radiation safety program. Worker education and qualifications. Safe work procedures. Restricted access. Exposure monitoring.	Gloves, protective clothing, protective eyewear.

Support Services – Pharmacy Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments including scalpels, scissors and medical instruments.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures. Appropriate sharps disposal.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from broken glassware, including bottles.	Substitute with other materials (plastics). Change procedure to reduce usage. Use of centrifuge carriers with caps.	Worker education. Safe work procedures including removal of broken items from equipment safe disposal of sharps, etc.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from using equipment and tools.	Machine guarding. Interlock systems on equipment. Work area design.	Worker education. Authorized personnel only in area. Safe work procedures.	Cut-resistant gloves if appropriate. Eye protection.
Burns from using heat sealers for blister packaging, etc.	Machine guarding, equipment design and placement, equipment maintenance.	Worker education. Safe work procedures. Appropriate signage.	
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Support Services – Biomedical Equipment Management

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward postures) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Biomechanical hazards associated with material handling of instruments, equipment and supplies including lifting, carrying, pushing, pulling, etc.	Ergonomically designed storage areas with adequate space. Ergonomically designed instruments, equipment and carts 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 MSIs. Stretches and micro-breaks. Purchasing standards for material handling equipment. Maintenance program for equipment and instruments.	
Falling hazards associated with slips, trips and falls.	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.

Support Services – Biomedical Equipment Management Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Cuts from sharp instruments including scalpels, scissors and medical instruments.	Avoid use of sharps when not required. Replace sharps with Safety Engineered Medical Devices. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from blades and other sharp devices in equipment.	Machine guarding.	Worker education. Safe work procedures. Communication/ alert procedures.	Eye protection, protective clothing, and gloves as per hazard assessment.
Noise from equipment and machinery in noisy work areas, or from operation of noisy machinery or tools.	Substitution with quieter equipment or processes. Alteration of machinery to reduce noise at the source or along path including modification, isolation and maintenance.	Noise management program. Worker training. Audiometric testing. Assess noise levels and perform routine exposure monitoring. Preventative maintenance program. Signs notifying of noisy areas.	Hearing protection devices.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Maintenance and inspection of vehicles. Work scheduling to prevent fatigue.	
Mechanical hazards from machinery during operation and repair.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs and alerts to guards for machinery that may start automatically.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Support Services – Maintenance

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward postures) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 hoists, forklifts, carts, trolleys, etc.	Safe work procedures including proper lifting procedures. Worker education and awareness sessions. Early reporting of signs and symptoms of MSIs. 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.	
Exposure to UV-C through the cleaning of UV lamps used as germicidal lamps found in microbiology laboratories and some biological safety cabinets.	Eliminate all non-essential use of UV lamps. Interlock systems on biological safety cabinets.	Worker education. Safe work procedures (including ensuring UV lamps are turned off before cleaning, etc.). Proper signage and warning when UV lamps are turned on.	Goggles with appropriate optical density to block UV rays when lamps are on.
Exposure to UV during welding.	Isolate area with curtains to absorb radiation if other workers are present in the area. Cover reflective surfaces.	Worker education, including when to seek medical aid. Maintenance of protective equipment. Proper signage. Safe work procedures.	Goggles with appropriate optical density to block UV rays.

Support Services – Maintenance Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to ultraviolet radiation from sunlight for outdoor workers.	Isolated chamber/vehicle for worker.	Worker education. Safe work procedures. Scheduling to reduce individual exposure. Schedule work at less-sunny times of day.	Protective clothing, sun glasses, required use of sunscreen.
Falling hazards associated with slips, trips and falls.	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.
Cuts from using equipment.	Machine guarding. Equipment choice and maintenance. Interlock system to prevent use when guards are not engaged.	Worker education. Safe work procedures. Communication/ alert procedures.	Eye protection, protective clothing, and gloves as per hazard assessment.
Cuts from yard work, including trimming, mowing, handling thorns, etc.	Equipment choice and maintenance.	Worker education. Safe work procedures. Safe disposal procedures.	Gloves and arm protectors. Protective clothing. Protective eyewear.
Noise from equipment and machinery in noisy work areas, or from operation of noisy machinery or tools.	Substitution with quieter equipment or processes. Alteration of machinery to reduce noise at the source or along path including modification, isolation and maintenance.	Noise management program. Worker training. Audiometric testing. Assess noise levels and perform routine exposure monitoring. Preventative maintenance program. Signs notifying of noisy areas.	Hearing protection devices.
Exposure to environmental heat when working outdoors (e.g. groundskeeping, external work/repairs).	Isolation of worker in climate controlled cab. Provision of cool rest area.	Worker education about the effects of environmental heat exposure. Communication system in case of emergency. Work-rest cycles. Work scheduling to avoid hottest times of day and long periods of exposure to heat. Provision of water. Awareness of and job modification for workers with vulnerability to heat. Emergency response procedures/equipment for exposures.	Light-weight clothing if possible.
Exposure to environmental heat when working in hot indoor environments (e.g. boiler rooms, ventilation systems).	Equipment maintenance. Portable ventilation devices.	Worker education about the effects of heat exposure. Communication system in case of emergency. Work-rest cycles. Work scheduling to avoid long periods of exposure to heat. Provision of water. Awareness of and job modification for workers with vulnerability to heat. Emergency response procedures/ equipment for exposures.	Light-weight clothing if possible.

Support Services – Maintenance Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Burns related to contact with hot surfaces, hot products, or steam.	Warning alarms on equipment. Interlock systems to prevent opening equipment which is hot. Isolation/shielding of hot equipment. Programmable automatic shut-offs on equipment. Temperature and pressure relief valves.	Worker education. Safe work procedures including proper use and maintenance of all equipment, proper positioning when performing tasks to reduce exposure.	Heat-resistant gloves, eye protection, protective clothing and footwear as required based on hazard assessment.
Exposure to environmental cold when working outdoors (e.g. snow removal, external work/repairs).	Well maintained vehicles with adequate heating where appropriate. Provision of warm rest area.	Worker education about the effects of environmental cold exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to cold. Awareness of and job modification for workers with vulnerability to cold. Emergency response procedures/equipment for exposures.	Multiple layers of clothing with inner layer of a "wicking" fabric, head cover, warm gloves (mittens if dexterity not required), warm and water proof footwear, face protection as necessary.
Fire, projectiles, or physical injury if compressed gas cylinders used for oxygen fuel torch systems are damaged, dropped or mishandled.	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. Flashback arrestor. Back flow preventers.	Safe work procedures that includes use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Pressure release, projectiles, fire or explosion if pressure vessels are damaged or fail.	Vessel design to legislative requirements. Pressure relief valves.	Pressure vessel safety program meeting legislated requirements. Vessel certification. Inspections. Worker training.	PPE based on hazard assessment.
Confined space entry hazards including atmospheric, safety, task related and human factors.	Eliminate the requirement to enter the confined space.	Confined space code of practice, hazard assessment, permit system, worker training, atmospheric testing, isolation and lockout, ventilation, emergency procedures. Signs posted at confined spaces to prohibit entry without a complete confined space entry permit.	PPE based on hazard assessment of the confined space.
Electrical hazards when using electric powered tools outdoors.	Ground fault circuit interrupters.	Inspections and preventative machine maintenance. Safe work procedures. Worker training.	Protective footwear.

Support Services – Maintenance Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Maintenance and inspection of vehicles. Work scheduling to prevent fatigue.	
Mechanical hazards from machinery during operation and repair.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs and alerts to guards and machinery that may start automatically.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.
Mechanical hazards from machinery in areas where machinery is in use.	Safeguarding of machinery.	Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs and alerts to guards and machinery that may start automatically.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.
Incidents involving overhead cranes and hoists that can result in serious injury and damage, physical injury to the head, feet, eyes, face, body, and hands.	Crane and rigging design and manufacture that meets required safety standards.	Competent hoist operators and riggers. Safe work policies and procedures. Worker training. Use taglines for awkward loads. Crane and rigging inspections.	Protective footwear for impact hazards. Eye protection. Head protection (hard hats). Gloves.
Incidents involving ratchet lever hoists that can result in serious injury and damage, physical injury to the head, feet, eyes, face, body, and hands.	Hoist and rigging design and manufacture that meets required safety standards.	Worker training. Hoist and rigging inspections. Safe work procedures.	Protective footwear for impact hazards. Eye protection. Head protection (hard hats). Gloves.

Support Services – Administration and Information Technology

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Falling hazards associated with slips, trips and falls.	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.
Cuts from sharp instruments including scissors and box cutters.	Avoid use of sharps when not required. Proper storage and disposal of sharps.	Worker education. Safe work procedures.	Gloves as per hazard assessment.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	

Support Services – Drivers

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with driving include sustained postures (and potentially awkward postures) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Falling hazards associated with slips, trips and falls.	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.
Exposure to environmental heat from traveling outdoors.	Well maintained vehicles with adequate air conditioning.	Worker education about the effects of environmental heat exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to heat. Provision of water. Awareness of and job modification for workers with vulnerability to heat. Emergency response procedures/ equipment for exposures.	Light-weight clothing if possible.

Support Services – Drivers Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to environmental cold from traveling outdoors.	Well maintained vehicles with adequate heating.	Worker education about the effects of environmental cold exposure. Communication system in case of emergency. Work scheduling to avoid long periods of exposure to cold. Awareness of and job modification for workers with vulnerability to cold. Emergency response procedures/equipment for exposures.	Multiple layers of clothing with inner layer of a "wicking" fabric, head cover, warm gloves (mittens if dexterity not required), warm and waterproof footwear, face protection as necessary.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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 include use, care, maintenance, storage and transport. Transportation of Dangerous Goods program. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles, including ambulances.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Maintenance and inspection of vehicles. Work scheduling to prevent fatigue.	

Support Services – Materials Management, Shipping, Receiving, Warehouse

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with computer use or workstation design.	Ergonomically designed workstations, chairs and equipment. Incorporate adjustable workstations to accommodate shared use by employees of various sizes.	Adjustment of workstation and chair to fit user. Worker education regarding biomechanical 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 MSIs. Stretches and micro-breaks. Purchasing standards for ergonomically designed computer workstations, chairs and equipment. Ergonomic assessments. Maintenance of workstations, chairs and equipment.	
Biomechanical hazards associated with driving include sustained postures (and potentially awkward postures) and duration.	Select an appropriately designed vehicle which incorporates ergonomic and adjustable features. Consider a retrofit back support if the lumbar support in the vehicle seat is inadequate.	Adjust the seat and other features of the vehicle to fit the worker. Follow safe work procedures. Early reporting of signs and symptoms of MSIs. Stretches and micro-breaks. Vary driving position and vary tasks, when possible. Maintain vehicle.	
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	

Support Services – Materials Management, Shipping, Receiving, Warehouse

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Falling hazards associated with slips, trips and falls.	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.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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. Transportation of Dangerous Goods program. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Maintenance and inspection of vehicles. Work scheduling to prevent fatigue.	
Mechanical hazards from garbage compacters.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs informing of guards.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Others – Contractors

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Biomechanical hazards associated with material handling of equipment, furniture and supplies including lifting, carrying, pushing, pulling, etc.	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 MSIs. 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.	
Falling hazards associated with slips, trips and falls.	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. Train workers to inspect and use ladders correctly and to wear appropriate footwear. 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.
Noise from equipment and machinery in noisy work areas, or from operation of noisy machinery or tools.	Substitution with quieter equipment or processes. Alteration of machinery to reduce noise at the source or along path including modification, isolation and maintenance.	Noise management program. Worker training. Audiometric testing. Assess noise levels and perform routine exposure monitoring. Preventative maintenance program. Signs notifying of noisy areas.	Hearing protection devices.
Fire, projectiles, or physical injury if compressed gas cylinders used for a variety of procedures and maintenance activities are damaged, dropped or mishandled.	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. Transportation of Dangerous Goods program. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.
Fire, projectiles, or physical injury if compressed gas cylinders used for oxygen fuel torch systems are damaged, dropped or mishandled.	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. Flashback arrestor. Back flow preventers.	Safe work procedures that include use, care, maintenance, storage and transport. Worker training.	PPE based on hazard assessment and type of compressed gas. Protective footwear for impact hazard when handling large cylinders.

Others – Contractors Continued

Potential Physical Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Confined space entry hazards including atmospheric, safety, task related and human factors.	Eliminate the requirement to enter the confined space.	Confined space code of practice, hazard assessment, permit system, worker training, atmospheric testing, isolation and lockout, ventilation, emergency procedures. Signs posted at confined spaces to prohibit entry without a complete confined space entry permit.	PPE based on hazard assessment of the confined space.
Electrical hazards arising from use of electrical cords and appliances.	Ground fault circuit interrupters when used close to water sources.	Safe work procedures that include use of electrical cords, power bars and appliances that include facility approval requirements. Worker training.	
Motor vehicle collisions from driving vehicles.	Purchasing standards for vehicles.	Safe work procedures for driving including the issue of cell phone use. Confirm driver qualifications. Driver training. MV incident reporting process. Maintenance and inspection of vehicles. Work scheduling to prevent fatigue.	
Mechanical hazards from machinery during operation and repair.	Safeguarding of machinery.	Control of hazardous energy (lockout) program. Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs and alerts to guards and machinery that may start automatically.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.
Mechanical hazards from machinery in areas where machinery is in use.	Safeguarding of machinery.	Inspections and preventative machine maintenance. Safe work procedures. Only authorized workers operate specific machinery. Worker training. Signs and alerts to guards and machinery that may start automatically.	PPE based on hazard assessment and machinery hazards. No loose clothing, gloves, or jewelry or other items that could entangle workers in machinery.

Appendix 1

References Used in Preparing this Document

Appendix 1 – References Used in Preparing this Document

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Non-patient Lifting Device Hazards Section

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Patient Handling Equipment Section

Legislation and Guidelines

Alberta Government; *No Unsafe Lift Workbook;* n.d.; **employment.alberta.ca/documents/WHS/WHS-PUB_nounsafelift_workbook.pdf**

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Lockout

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Appendix 2

Glossary of Terms

Appendix 2 – Glossary of Terms

Awkward postures: Non neutral positions adopted by a worker to perform a task.

Confined space: A restricted space which may become hazardous to a worker entering it because of:

a. an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity,

b. a condition or changing set of circumstances within the space that presents a potential for injury or illness, or

c. the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

Cut: A cut is a break in the skin.

Dosimeters: Devices that measure the "dose" of exposure a worker receives.

Ergonomics: Fitting the job or task to the man.

Frostbite: Caused by exposure to extreme cold or by contact with extremely cold objects (e.g. metal). Frostbite occurs when tissue temperature falls below freezing (0°C), or when blood flow is obstructed under cold conditions. Blood vessels may be severely and permanently damaged, and blood circulation may stop in the affected tissue.

Frostnip: Occurs when ear lobes, noses, cheeks, fingers, or toes are exposed to the cold and the top layers of the skin freeze. The skin of the affected area turns white and it may feel numb. The top layer of skin feels hard but the deeper tissue still feels normal (soft).

Excess Noise: Noise that exceeds the limits specified in Section 218 of the Alberta OHS Code.

Hazardous energy: Electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or any other form of energy that could cause injury due to the unintended motion energizing, start-up, or release of such stored or residual energy in machinery, equipment, piping, pipelines, or process systems.

Heat cramps: Sharp pains in the muscles that may occur alone or be combined with one of the other heat stress disorders.

Heat edema: Swelling which generally occurs among people who are not acclimatized to working in hot conditions.

Heat exhaustion: Caused by excessive loss of water and salt.

Heat rash: Tiny red spots on the skin, which cause a prickling sensation.

Heat stroke and hyperpyrexia (elevated body temperature): Most serious types of heat illnesses. Signs of heat stroke include body temperature often greater than 41°C, and complete or partial loss of consciousness

Hypothermia: Occurs when the body is unable to compensate for its heat loss and the body's core temperature starts to fall. As the body continues to cool, muscular weakness, an inability to think clearly, and drowsiness are experienced. This condition usually occurs when the body's internal or core temperature falls below 33°C. Additional symptoms include shivering coming to a stop, diminished consciousness and dilated pupils. When the core temperature reaches 27°C, coma (profound unconsciousness) sets in.

Heat syncope: Heat-induced giddiness and fainting induced by temporarily insufficient flow of blood to the brain while a person is standing.

Interlock Systems: A mechanism to prevent the operation of some part of the equipment until all controls are in place.

Ionizing Radiation: Movement of sufficient energy through space to impact atoms of molecules and create ions which can cause changes to cells.

Laser: "Light Amplification by Stimulated Emission of Radiation", non-ionizing radiation of a single wavelength used for surgical procedures and patient positioning.

L_{ex}: A workers' integrated average noise exposure over their work shift that has been corrected for work shifts other than 8 hours.

Lux: A metric unit of illumination. 1 lux is equivalent to 1 lumen per square metre.

Magnetic resonance imaging (MRI): A form of non-ionizing radiation that utilizes magnetic fields to visualize properties of tissues.

Millisievert (mSv): The sievert (Sv) is the unit of radiation equivalent dose that is used for radiation protection purposes, for engineering design criteria and for legal and administrative purposes. It is the SI unit of absorbed radiation dose in living organisms modified by radiation type and tissue weighting factors. The sievert is also the unit of dose for the terms "equivalent dose" and "effective dose". It replaces the classical radiation unit the rem. Multiples of sieverts (Sv) include millisieverts (mSv) and microsieverts (µSv).

Musculoskeletal injury (MSI): An injury of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissues that is caused or aggravated by work, including overexertion injuries and overuse injuries.

Non-ionizing energy: Movement of energy through space that is at a lower level and does not cause the formation of ions. Non-ionizing radiation may cause other biological effects such as heating, skin damage, or eye damage.

Overexertion injury: Sprains, strains and tears resulting from excessive physical effort as might happen during lifting, lowering, pushing, pulling, etc.

Overuse or repetitive motion injuries: Injuries resulting from repeated overuse of a part of the body. While it is commonly believed that computer users experience high levels of repetitive motion injury, the problem is rarely recognized among those workers who use their hands extensively in food processing, materials handling and the professional trades.

Personal Protective Equipment (PPE): Specialized equipment or protective clothing used by health care workers to protect themselves from exposure to hazards such as radiation, noise or temperature extremes. Personal protective equipment may include gloves, lead aprons, gowns, eye protection, and ear plugs.

Pressure vessel: A vessel used for containing, storing, distributing, processing or otherwise handling an expansible fluid under pressure.

Restricted space: An enclosed or partially enclosed space, not designed or intended for continuous human occupancy, that has a restricted, limited or impeded means of entry or exit because of its construction.

Safeguard: A guard, shield, guardrail, fence, gate, barrier, toe board, protective enclosure, safety net, handrail or other device (excluding PPE) designed to protect workers operating equipment or machinery

Safety-engineered medical sharp: A medical sharp that is designed to, or has a built in safety feature or mechanism that will eliminate or minimize the risk of accidental parenteral contact while or after the sharp is used.

Shielding: A control used for reducing exposure to radiation by blocking the path of transmission.

Sustained postures: Postures that are maintained for prolonged periods without giving the body a chance to change positions.

Threshold Limit Value® (TLV®): TLVs® are guidelines (not standards) designed for use by industrial hygienists in making decisions regarding safe levels of exposure to various chemical substances and physical agents found in the workplace.

Ultrasound: A form of non-ionizing radiation that uses low frequency radiation.

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