Alberta Construction Safety Association

Working Around Powered Mobile Equipment

Industry Best Practices

Table of Contents

Introduction

Powered mobile equipment (PME) makes work at a site easier and more efficient but create serious hazards for the people who work around them.

Workers have the right to know the hazards of what they are working with, the right to participate in work site health and safety activities, and the right to refuse unsafe work.

The intent of these best practices is to provide field level safety people, crew leaders, and supervisors with the information they need to effectively deliver tool box talks and safety meetings on a variety of PME-related topics.

What is Powered Mobile Equipment?

The Alberta Occupational Health and Safety Code provides a definition of powered mobile equipment (PME).

The three key elements are listed below.

1. A self-propelled machine **and**
2. Has a prime mover or motor vehicle **and**
3. Is designed to manipulate or move material or be used as a power aerial device.

Purpose-built PME vs. Commercial/Fleet Vehicles

The focus of this industry best practice is on *purpose-built* PME which are usually designed from the ground up as a specialized piece of equipment. The characteristics of purpose-built PME are listed at the top of the next column.

Commercial/Fleet vehicles are usually based on a commercially available chassis and range in size from pick-up trucks to semi-trailer/multi-axle configurations. Commercial/Fleet vehicles are considered to be PME under OHS Code Part 19 but are *not* the focus of this best practice.

The common characteristics of ***purpose-built*** PME are in the list below.

- Heavy components
- Irregular or unusual shapes
- Unusual steering systems
- Unexpected pivot and pinch points
- Hydraulic-assisted components
- Multiple directions of motion
- Large operator blind spots
- Excessive noise

Common examples of purpose-built PME

Backhoe/Backhoe-Loader

Loader

Grader/Motor Grader

Dozer/Bull Dozer/Crawler Tractor

Excavator/Tracked Backhoe

Fork Lift/Lift Truck

Scraper/Earth Mover

Haul Truck/Rock Truck

Compactor

Roller

Paver

Skid Steer

Mobile Crane

Telehandler

Aerial Work Platforms

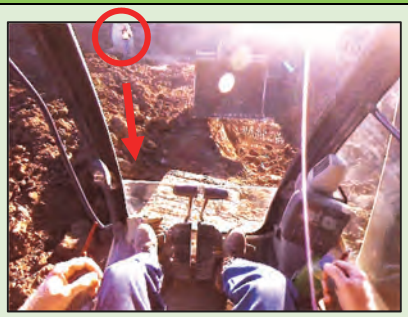
Other examples of PME used in or around work sites are listed below.

- Pipe layers/Side booms
- Draglines (mining)
- Road reclaimers
- Drills (directional, augers, etc.)
- Shovels (mining)
- Milling machines (asphalt)
- Slab finishers (concrete)
- Mulchers (brush cutters, mowers, etc.)
- Tractors (agricultural)
- Pile drivers
- Trenchers

Safely Approaching PME

The steps to take when approaching PME are the same for **all** workers. Workers or spotters should follow the five steps shown below before entering the swing zone or safe distance area of any PME.

Worker wants to approach PME



Step 1 – Establish eye contact with operator.

Step 2 – Communicate your intent to approach.

Step 3 – Wait for operator to acknowledge you.

Step 4 – Wait for PME to be put into safe mode.

Step 5 – Wait for operator to signal you to approach.

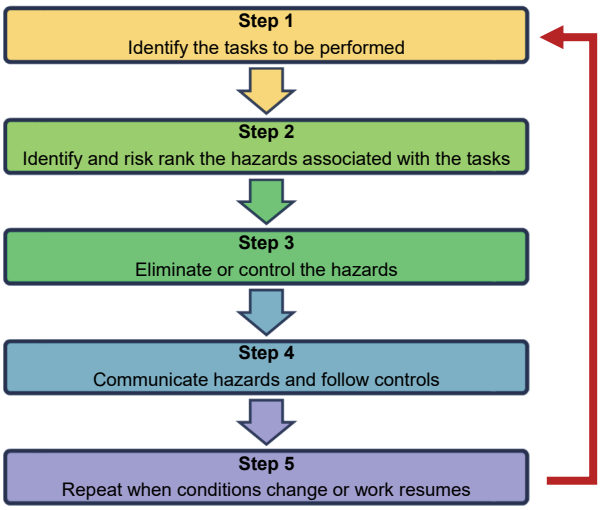
Safely approach the PME

Hazard Assessments

Hazard assessments (HAs) are one of the most important things done to help protect workers. Companies complete formal HAs before a project starts. Supervisors and workers complete site-specific HAs before work on a specific job or task starts.

Site-specific Hazard Assessment Process

Site-specific HAs help crews develop a plan to eliminate or control hazards so they can do their jobs safely. The ACSA uses the five-step model created by the Government of Alberta (GoA).



Adapted from: Government of Alberta, 2015. *Hazard Assessment and Control: a handbook for Alberta employers and workers.*

Site-specific hazard assessments are also called Field Level Hazard Assessments (FLHAs).

Step 1
Identify the tasks to be performed

Identify all of the PME that may be used to complete the tasks.

Example – Drywall		
Job	**Tasks**	**PME**
Putting up drywall (commercial)	• Unloading • Positioning • Cutting • Placing • Mudding • Taping • Sanding	• Telehandler (unloading and positioning) • Aerial work platform (AWP) (working at height)

Step 2
Identify and risk rank the hazards associated with the tasks

The Seven Main PME-Related Hazards
Blind spots
Traps (pinch points)
Swing zones
Suspended loads
Silica
Noise (sound level)
Harmful products

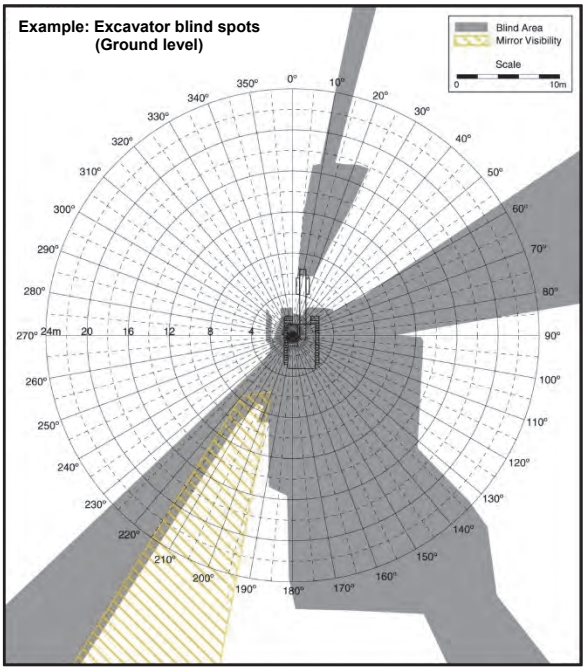
Working at heights is another PME related hazard (e.g., aerial work platform)

Risk can be ranked using words (high, medium, low), using numbers (1, 2, 3), alphanumeric assignment (1A, 2B, 3C), or a matrix.

Rank hazards using your company's hazard ranking system.

Blind spots

- An area where the view of the operator is blocked by sections of the cab or by parts of the PME
- *Workers in blind spots may be crushed, struck by, or run over because the operator cannot see them*



Adapted from: Centers for Disease Control and Prevention — National Institute for Occupational Safety and Health, Division of Safety Research. *Highway Work Zone Safety: Construction Equipment Visibility.* Last updated April 7, 2009.

Traps (pinch points)

- Areas on or around the PME where it is possible for a worker to become caught or trapped
- *Workers may be crushed or have body parts crushed*
- *Hazard is greater if the worker is also standing in a blind spot*

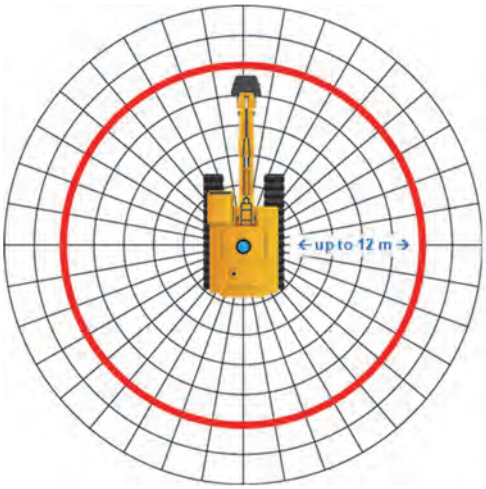
One type of trap relates to specific locations on PME where a worker, or part of a worker, ends up between two parts of the PME.

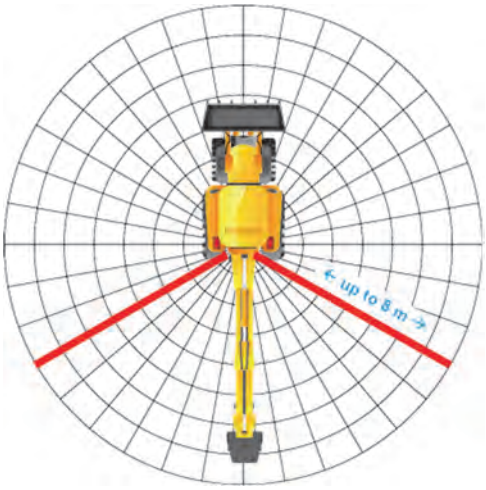
The second type of trap is a work area where a worker ends up between the PME and another object. There are three common work areas where this can happen.

- Between a part of a PME and an object
- Between two pieces of PME
- Between two objects where PME is moving one or both of the objects

Swing zones

- Areas around the PME where parts of the PME can extend and/or swing in multiple directions (e.g., buckets, counterbalances, etc.)
- *Workers in a swing zone may be struck or crushed*
- *Hazard is greater if the worker is also standing in a blind spot.*





Suspended loads

- Loads or materials that can be carried above ground level
- *Potential for workers to be struck by loads or materials that may fall*
- *Workers under suspended loads can be crushed or buried by falling loads or materials*
- *Hazard is greater if the worker is also standing in a blind spot*

If the ground conditions are uneven, the chance of a load or part of a load falling or swinging increases greatly.

Silica

Almost all forms of soil, sand, and rock used in construction contains silica. Respirable crystalline silica (RCS) is the smallest form of silica and can easily enter the lungs. Exposure to RCS can lead to long-term health effects such as silicosis, chronic obstructive pulmonary disease (COPD), and cancer.

Noise (sound level)

- Excessive sound levels produced mainly by the prime mover (usually a diesel engine)
- *Workers exposed to excessive noise from PME over time can experience permanent hearing impairment or loss*
- *Hearing loss is considered an occupational disease by Alberta OHS*

Workers exposed to sound levels over 85 dBA require some form of hearing protection. Most PME produce sound levels between 90dBA and 110 dBA or higher.

Harmful products

- Chemicals produced by PME or used as part of the operation of PME that can impact the health of workers

Exhaust gases

- All PME powered by hydrocarbon fuels produce harmful exhaust gases (e.g., gasoline, diesel, propane, etc.)
- *Exhaust gases can cause short-term and long-term health effects*

Fumes and liquids

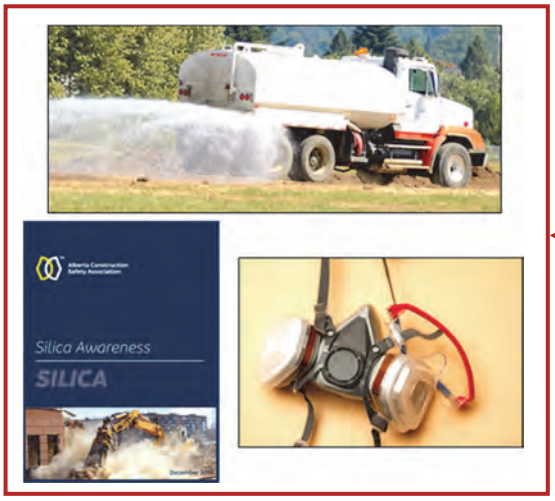
- Some PME exposes workers to other harmful products (e.g., workers on asphalt pavers are exposed to high levels of asphalt oil fumes and may have skin contact with diesel fuel used for cleaning equipment.)
- *Acute exposures can result in headaches, skin rashes, fatigue, reduced appetite, throat and eye irritation, and cough. Chronic exposures can lead to cancer.*

Additional Hazards	Examples and Potential Issues for Workers (outcomes)
Poor weather (current or forecasted)	**Examples** • Temperature • Wind and/or wind chill • Precipitation **Potential Issues** • Distractions due to hyperthermia, dehydration, fatigue, additional PPE, etc.
Distracting light levels	**Examples** • Low light (dusk/dawn) • Overcast/fog • Bright sun/high UV index • Darkness **Potential Issues** • Visibility issues for operators • Unexpected movements of PME due to visibility issues for operators • Sun burn/skin cancer
Poor ground conditions	**Examples** • Slopes • Ruts • Frozen soil/ice on road • Muddy/sloppy soil • Unstable/soft soil **Potential Issues** • Slip, trip, and fall issues resulting in visibility issues for operators • Unexpected movements of PME or suspended load • PME rollovers
Low clearances	**Examples** • Temporary utilities • Entrances/entry areas • Process piping • Forested areas **Potential Issues** • Instability in suspended loads • Falling building or structure components • Electrified area around PME • Harmful product release
Improper loading	**Examples** • Oversize/unusual shape • Overloading • Imbalance/instability • Poor load securement **Potential Issues** • PME rollover • Unplanned dumping of load • Building or structure contact
Operator-related	**Examples** • Not fit for duty • Fails to follow SWPs/SJPs • Distracted/not competent • Risk tolerance too high **Potential Issues** • Injury or death
Other	**Examples** • Traffic • Wildlife/animal encounters • Bodies of water **Potential Issues** • Collisions • Animal attack • Drowning

Step 3
Eliminate or control the hazards

Eliminating PME from a work site today is not usually an option for companies. When unable to eliminate PME from a work site, use the hierarchy of controls.

Hierarchy of controls
Examples by type of control
Engineering (includes substitution) • Electric vs. fueled • Auto-stop technologies • Restricted access to PME operating areas • Fenced or designated walkways and driveways • Dust control (silica) • Guards (traps/pinch points on PME)
Administrative • SWPs, SJPs, and company rules • Orientations, training, and safety meetings • Preventative maintenance • Warning devices (lights, alarms, etc.) • Radio Frequency Identification tags (RFID) • On-board cameras and mirrors • Signage and boundary guards (silica)
Personal protective equipment (PPE) • High visibility clothing or vests • Hard hats, safety boots, and safety glasses • Hearing protection • Respiratory protection (silica, harmful products) • Gloves (harmful products) • Fall protection (AWPs)
Combination (e.g., reduce worker exposure to silica) *Engineering → Water trucks for dust control* *Administrative → Worker training* *PPE → Safety glasses and respirators*



Step 4
Communicate hazards and follow controls

Remember to…

- Review the site-specific HA at safety briefings
- Ask questions about the hazards and controls
- Identify if sub-contractors will be providing PME
- Confirm communication methods and signals
- Refuse to start work if there is dangerous work

Step 5
Repeat when conditions change or work resumes

Remember to review the HA and reassess if…

- Weather or lighting conditions change
- New PME starts operating in the work area
- The PME is now being used in a different way
- Additional crews arrive in the work area
- The operator of the PME changes
- Any other conditions change in the work area that could affect the safety of workers

Working Around PME Safety Concepts (Overview)

Understand Workers' Rights

- Workers have the right to know about work site hazards
- Workers have the right to participate in work site health and safety activities
- Workers have the right to refuse unsafe work

Develop an internal responsibility system

- All people at a work site must do their part to make sure the work site is safe for everyone (Obligations and duties in the OHS Act)

Use additional industry best practices, SWPs, and SJPs

- Practices and procedures generally accepted as being the best way to perform jobs or task based on reviews of industry safety statistics and incidents (i.e., lessons learned)
- Create opportunities for workers to sit behind the controls of the PME they will be working around so that they can become familiar with some of the PME's blind spots. Note PME should be powered off and secured from accidental start-up.

Become Task Aware

- Complete PME familiarization
  - Blind spots, traps, swing zones, suspended loads, noise, silica, and harmful products
- Review PPE and RPE requirements
- Discuss operator responsibilities
- Agree on communication methods/signals
- Review procedures for specialized tasks
  - Refueling/servicing
  - Pipe laying
  - Trenching/excavating
  - Critical lifts
- Review procedures for unusual circumstances
  - Using PME not designed for the task (improvising)
  - Using PME not planned for the task (short cutting)

Resources to become task aware

Site-specific hazard assessments
SWPs/SJPs
Codes of practice
Training seminars/courses
On-the-job training (OJT)
Tool box talks
Safety alerts
Safety stand downs
Safety meetings

Maintain situational awareness

- Operator-related
  - Is the operator still in the cab?
  - Is the operator still using the PME safely?
  - Has a new operator taken over the PME?
  - Are there communication problems?
- PME-related
  - Is new PME arriving in the work area?
  - Are the blind spots changing?
  - Is the load still balanced and secure?
  - Have the swing zones changed?
  - Are the escape routes still accessible?
- Environment-related
  - Are the weather conditions changing?
  - Are the light levels changing?
  - Are ground conditions changing?
- Worker-related
  - Are workers developing tunnel vision?
  - Are workers becoming fatigued?
  - Are distractions increasing?
  - Is the pace of work increasing?
  - Is risk tolerance increasing?
  - Are new crews arriving in the area?

Resource to maintain situational awareness

Reassess site-specific hazard assessment

e.g., Changing light conditions (notice the long shadows)

e.g., Operating in low light (early morning, twilight, night shift)

Spotters vs. Flaggers

Spotters are responsible for one piece of equipment at a time. Flaggers control all ground traffic at a work site.

Training for spotters and flaggers is different because the jobs are very different.

Applicable Alberta Occupational Health and Safety (OHS) Legislation

Highlights of the OHS Act ***(Effective June 1, 2018)***

Section 3 – Obligations of employers

- Ensure health, safety, and welfare of workers
- Ensure workers are aware of their rights and duties
- Ensure workers are supervised by someone who is competent
- Ensure workers are adequately trained
- Ensure workers do not work in a dangerous condition until the condition has been remedied

Section *4 – Obligations of supervisors*

- Take all precautions to protect the health and safety of workers they are supervising
- Ensure workers they are supervising use all hazard controls and required PPE
- Advise workers they are supervising of all known or reasonably foreseeable hazards to health and safety in the area where they are working
- Ensure workers do not work in a dangerous condition until the condition has been remedied

Section 5 – Obligations of workers

- Take reasonable care to protect the health and safety of themselves and other persons at the work site
- Cooperate with the employer and supervisor to protect the health and safety of workers
- Use all devices and PPE designated and provided for their protection
- Report unsafe or harmful acts or conditions to their employer or supervisor

Section 31 – Right to refuse dangerous work

- Workers may refuse to work if they believe on reasonable grounds that there is a dangerous condition at the work site or the work constitutes a danger to workers' health and safety
- Workers must promptly report the refusal and the reasons for it to the employer or a supervisor
- Workers may continue to refuse to work until the dangerous condition is remedied

Section 35 – Prohibition of disciplinary action

- No person shall take discriminatory action against any workers refusing to work in a dangerous condition

Highlights of the OHS Regulation

Section 12 – Equipment

- Employer must ensure equipment has proper maintenance, function, and strength

Section 13 – General protection of workers

- Employer must ensure workers are **competent** or under **direct supervision** if not competent
- Employers must ensure workers are familiar with procedures
- Employers must ensure workers are competent in use of safety equipment
- Employers must ensure workers perform required duties

Section 14 – Duties of workers

- Worker must not perform work if they are not **competent** or not under **direct supervision**
- Worker must report equipment not meeting requirements (see s.12 above)

Section 15 – Safety Training

- Employers must train workers to operate equipment
- Workers must participate in training
- Workers must apply training

Competent (OHS definition)

1. Qualified (e.g., certificates, tickets, trades qualifications if a regulated trade)
2. Trained (e.g., orientations, on-the-job training, safety training)
3. Sufficient experience to work with minimal or no supervision
   (e.g., performance observations, reviews)

Direct Supervision (OHS definition)

1. Must be done by a competent worker
2. Must be done personally and visually
   (e.g., supervisor can see the worker and can intervene if there is a problem)
3. Must be able to communicate readily and clearly with the worker

Highlights of the OHS Code

Part 2 – Hazard Assessment, Elimination, and Control

- Employer must conduct hazard assessments
- Employer must involve workers in hazard assessments
- Workers must be informed by the employer of the hazards and their controls

Part 7 – Emergency Preparedness and Response

- Employer must develop an emergency response plan
- Emergency response plan must include procedures for dealing with identified emergencies

Part 12 – General Safety Precautions

Signallers

- Designated signallers must be competent
- Designated signallers must be clearly identifiable
- Operators must only take signals from one designated signaller (except for stop signals)
- Operators must comply with a stop signal from any worker

Part 16 – Noise Exposure

- Employer must take all reasonable measures to reduce worker exposure to noise (exposure limits are in Schedule 3 of the OHS Code)
- Employer must provide hearing protection to workers exposed to excessive noise (OHS Code s.222 and OHS Code Explanation Guide p.16-3)
- Employer must train workers in the selection, use, and maintenance of hearing protection
- Employer must provide hearing tests to workers exposed to excessive noise
- Workers must use the hearing protection provided by the employer

Part 18 – Personal Protective Equipment (PPE)

- Employer must ensure workers wear PPE
- Employer must ensure workers are trained in the correct use, care, limitations, and maintenance of assigned PPE
- Workers must use and properly wear all assigned PPE
- Workers must inspect all assigned PPE before wearing it

Part 19 – Powered Mobile Equipment

- Workers must not remain within range of a moving load or part of the PME if there is a danger to the workers
- Employer must ensure workers use designated walkways or develop SWPs to protect workers entering areas where PME is operating
- Workers must not ride on top of loads being moved by PME
- Any elevated parts of the PME being maintained or repaired must be blocked in place to prevent accidental movement

Dangerous Movement (Part 19 s.258)

Employers must restrict entry if a worker could be caught between a moving part of a PME and another object. Workers must maintain a clearance of at least 600 mm between the PME and an object

Part 23 – Scaffold and Temporary Work Platforms

- Workers must not travel in a basket, bucket, platform, or other elevated or aerial device that is moving if road conditions, traffic, overhead wires, cables or other obstructions create a danger to the workers
- Workers cannot be on a fork mounted work platform if the PME it is attached to is moving horizontally

Operator Duties (What should workers look for?)

Operators must...

- Operate the PME safely at all times
- Maintain full control of the PME at all times
- Move a load or the PME only if workers are not exposed to danger
- Remain at the controls until the PME is secured against unintentional movement
- Remain at the controls until a suspended or elevated part is landed, secured in a safe position, or both
- Remain at the controls of the PME when a worker is on a fork-mounted work platform
- Start the PME only if the drive mechanisms or clutches are engaged

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