ALBERTA ELECTRICAL UTILITY SAFETY ASSOCIATION GUIDE TO DEVELOP A CODE OF PRACTICE FOR WORKING IN THE VICINITY OF ELECTRICAL EQUIPMENT

1.0 PREFACE

1.1 This Guide was developed to meet three objectives:

- to reduce the number of accidental electrical equipment contacts
- to assist workers to work safely in close physical proximity of electrical lines and equipment
- to assist the workers in applying appropriate emergency response measures in the event of an electrical utility contact

1.2 This Guide was written to assist contractors and does not replace or supersede provincial legislation. The work practices within this document have been developed and approved for technical merit by industry stakeholder's across Alberta. This document is based upon several fundamental assumptions;

- workers operating machinery in the vicinity of electrical equipment be trained in this Code of Practice
- workers are familiar with and can demonstrate safe work practices and standards of their respective industries
- any Code of Practice is site specific and therefore a worksite hazard assessment must be completed first to determine the nature of the hazards present.

1.3 A Code of Practice is a more rigorous approach to safe work practices which when accepted by industry has the advantage of becoming a generally accepted industry practice. As such, it is a cost effective alternative to legislated regulation or no standards at all. Implementing this Code of Practice will reduce the costs of WCB incident investigation, utility line identification, power outage, damaged equipment, construction delays, and human pain and suffering.

2.0 DEFINITIONS

Competent: In relation to a worker and this Code of Practice, means adequately qualified, suitably trained and with sufficient experience, to safely perform work that is the subject matter of the relevant provision of this Code of Practice without or with only a minimal degree of supervision.
Conductor: Means a wire or cable or other form of metal capable of conveying electric current from one piece of electrical equipment to another or to ground.
Contractors: Organizations other than electrical utilities owners.
C.P.R.: Cardio Pulmonary Resuscitation.
ECUC: Alberta Electrical and Communication Utility Code.
Electrical Equipment: Overhead electrical lines, buried underground electrical cable.
Electrical Utility: An owner or operator of electrical equipment.

Excavating: Distributing soil or other surface materials by digging, boring or forcing objects into the ground or earth surface (pavement, etc.).
Hazard: The risk of injury to people, damage to equipment or loss of production by contacting an electrical utility.
Locate Slip: Documentation provided by the Locators at the time and place of the locates to the Contractor. This slip identifies the location of buried electrical utilities near the site of the actual excavation.
Meter: A device for measuring.
Metre: A unit of measurement.
Near: Means in such proximity as may give rise to the possibility of interference.
Power Line: Electrical wire or wires.
Safe Work Procedures: Process of identifying hazards, developing controls for these hazards and communicating the hazards and hazard controls to every worker.
Step Potential: The potential electrical difference between any two (2) points on the ground which can be touched simultaneously by a person.
W.C.B.: Workers' Compensation Board.

3.0 LEGISLATION & REGULATIONS

3.1 The Alberta Occupational Health and Safety Act, Regulation and Code assign specific responsibilities to the owner or prime contractor, the contractor, the employer, and the worker, to ensure that work is carried out in a safe manner. Safety legislation requires that all work related hazards be identified by the employer to the workers and that only competent workers are allowed to work without direct supervision (See Attachment 8.3 on Protection of Workers' and Hazard Assessment, Elimination and Control).

3.2 The Alberta Safety Codes Act and Electrical and Communication Utility Code (ECUC) contain specific instructions for people working in the vicinity of electrical equipment. See attachments (excerpts from the ECUC) at the end of this Code of Practice that deal with:

- Aerial activities performed near electrical equipment
- Excavation work near electrical equipment
- Interference with systems
- Moving equipment or buildings
- Special areas

4.0 SAFE WORK PLANNING

It must be determined at this stage whether the hazard is with underground or overhead electrical equipment or a combination of them. A site visit is required to assess the hazards. Always consider electrical utilities to be live with the potential of causing serious injury or death. Contact with electrical equipment (i.e. overhead line or buried cable) must be avoided at all cost. In developing a Safe Work Plan, consider such factors as;

- Scope of work
- Type of excavation, hoisting, or other equipment that will be required
- Height and reach of the equipment
- Equipment placement
- Equipment or material loading/unloading
- Worker competency
- Soil condition
- Interruptions to electrical services
- Hazard to public
- Use of ladders, pipe and other conducting materials
- Need to notify electric utility owner
- Need to communicate all hazards to all workers including contractors or sub-contractors
- Changing conditions
- Other hazards present (i.e. gas or chemicals)

4.1 Excavating

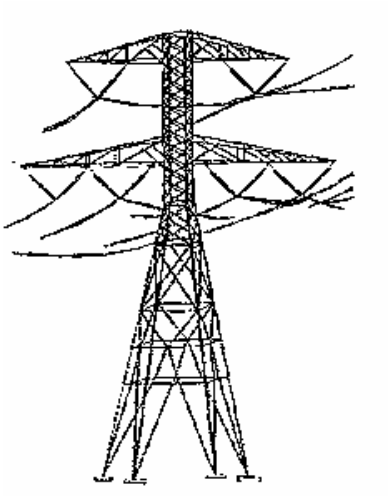
The Contractor shall ensure that the locations of all buried electrical cables are marked before work begins on any excavation. Arrangements to have this done can be made through Alberta One-Call at:

1-800-242-3447
or
www.alberta1call.com

At least two (2) full working days notice required.
Before using mechanical equipment within (1) metre of the locate marks, the buried electrical cables must be exposed, using non-destructive excavation techniques acceptable to the Electrical Utility. There may be several cables buried near each other, side by side, or at different depths. If the locate marks have been tampered with, or if you do not begin work within fourteen (14) days of the date locates were done, request relocates through Alberta One-Call.

In excavation planning, overhead electrical equipment must also be identified and controlled. Utility pole bases or other electrical equipment foundations and systems must not be exposed or damaged during excavation. Other considerations in safe work planning for excavation in the vicinity of buried electrical equipment include:

- Arranging to meet locators at site
- Marking locations of all buried electrical equipment on plans and drawings
- Reviewing locate slips before excavating
- Posting warning signs along the buried electrical equipment corridor
- Planning location of spoil piles so as not to reduce clearances to power lines



4.2 Overhead Electrical Equipment

Overhead power lines or wires are the electrical equipment contacted most often. Attachment 8.2 shows the distance from ground that lines are installed and maintained to permit the safe movement under the line of equipment, building or object.

These clearances may have been correct upon installation. In safe work planning it is essential to determine that the clearance has not been altered by such factors as buildings, landscaping or spoil piles. In some cases it may be required that safe work planning considers horizontal distances to electrical equipment, i.e. working on a bridge or a landfill berm or a building or scaffold near an overhead power line. There may be several services mounted on utility poles such as;

- More than one high voltage power line
- Low voltage power lines
- Telephone cables
- Cable T.V. cables

It is important not to contact any of these overhead services. Contacting the telephone lines for example, can cause power lines to break or come down. Contact the Electrical Utility to confirm line voltages or to measure the line to ground clearance. Call the Alberta One-Call number (1-800-242-3447, or www.alberta1call.com) to find out who operates the electrical utility in your work area. Unqualified persons must never attempt to measure clearances to power lines. The Electrical Utility can also assist in setting safe limits of approach and in developing a safe work plan.

Other considerations in safe work planning for work near overhead electrical equipment include:

- Marking location of all overhead power lines on plans and drawings
- Posting warning signs along their route
- Using a designated signaller
- Marking of the power lines to make them visible to the equipment operator
- Physical guarding of the overhead power lines
- Marking the limits of approach on the ground using a brightly coloured ribbon or rope.
- Moving the overhead power lines

- Shutting off the power to overhead power lines
- Covering the overhead power lines with electrical protective equipment
- Plan location of spoil pile, as not to reduce clearances to power lines
- Removing the automatic reclosing feature of power lines

4.3 Emergency Response Plan

The emergency response plan must be reviewed with the workers to ensure that if a contact occurs, every worker knows what to do. Emergency Response Plans should include:

- Knowing what to do if equipment becomes energized
- First aid
- Public protection
- Notification of authorities
- Availability and communication with emergency responders
- Medical aid beyond first aid

5.0 CRANES, EXCAVATION AND OTHER EQUIPMENT

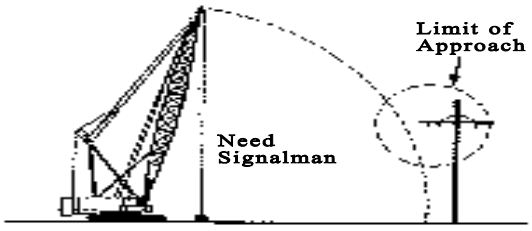
5.1 Whenever machinery is being used near electrical equipment, all workers in the vicinity shall be instructed to remain clear and out of contact with the frame of the equipment, hoisting lines or the hoisted load, except to attach or detach the load. The height, width, and maximum reach of the equipment shall be known by the operator of the machine. This information is available on the machine data sheet.

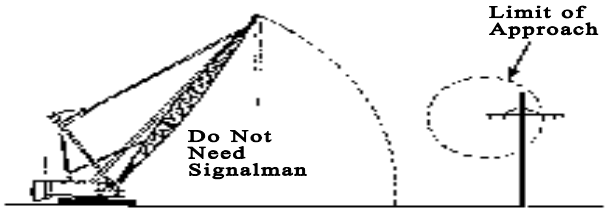
5.2 When working near electrical equipment **"Keep clear - working near electrical lines and apparatus"** signs will be displayed on the exterior of machines. A notice giving the following shall be posted in the cabs of machines working near electrical equipment:

- The limits of approach to overhead power lines for persons and equipment
- The machine shall not be moved near electrical equipment without the aid of a signaller
- Maximum height and reach of the machine with the boom or bucket fully extended (Machine Data Sheet) shall be posted in view of the operator of the machine.

5.3 A signaller or observer shall alone direct the moving of equipment near overhead power lines or other electrical equipment. The signaller shall be identified by a bright traffic vest and/or cuff. The designated signaller shall not be assigned any other duties during the times when the equipment is near the limits of approach. The operator and the signaller should know all crane and hoist hand signals (see Attachment 8.1).

The important consideration in signalling is that the signaller and operator understand each other completely and communicate effectively. The signaller shall know the limits of approach distances to overhead lines and ensure that at no time is there a Limit of Approach encroachment (see Attachment 8.1 on Signals).





6.0 ACCIDENTAL CONTACT

6.1 Effects of Electrical Contacts

In an electrical emergency, stay calm and think before you act. Don't become a victim while helping - call for help. If you try to pull the victim clear, you will also become a path for electricity.

The passage of electricity through the body is called "shock". A shock that may not be enough to kill or injure, can cause a worker to drop things or let go of the controls. This can result in a domino effect of undesired events. Small amounts of electrical current can cause involuntary muscle contractions and will prevent the victim from letting go of a conductor or calling for help.

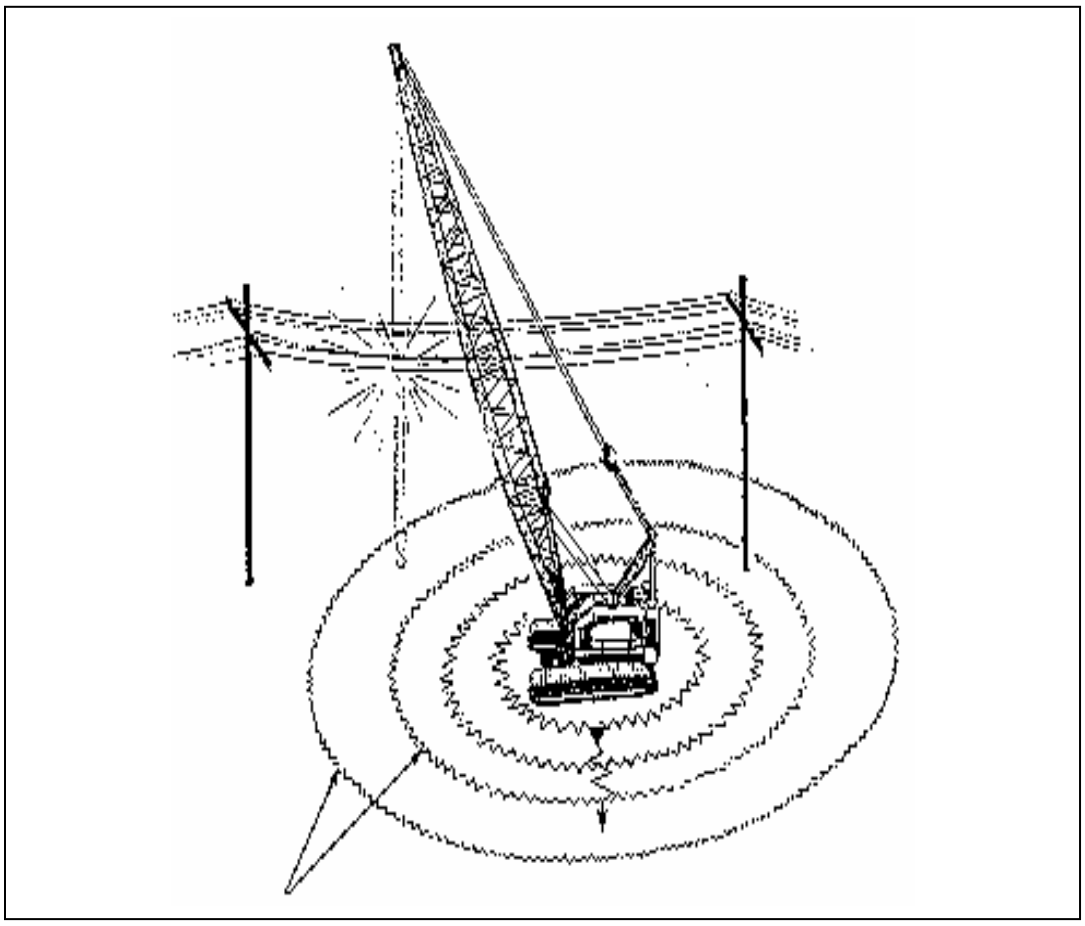
Burns are the most common electrical related injury. Electricity can cause severe burns at points of entry and exit. Although entry and exit wounds may be small, bone and muscle can be extensively damaged.

Electrical contact passing through the heart can cause the heart to stop beating.
The effects of an electrical contact are determined by:

- How much current is flowing through the body (measured in amperes and determined by voltage and resistance.)
- The length of time electricity path of current passes through the body.

6.2 Equipment in Contact with Electrical Conductor

If the equipment makes accidental contact with an electrical conductor, the operator shall try to remove the machine from contact in the best possible manner, without causing further damage such as pulling power lines to the ground. In most cases, this can be accomplished by moving the boom of the machine. If the machine cannot be moved, the operator shall stay on the machine, warn others in the vicinity to stay clear of the machine and ask someone to notify the Electric Utility. Remove the bucket from the ground in the case of an underground contact. Keep out of the excavation and do not touch the cables.



flowing down the boom and through the crane to ground. The ground will then be energized with a high voltage near the crane and lower voltage farther away

The operator should leave the machine only as a last resort; if the machine is on fire or other such emergency. If the operator has to leave a machine that is in contact with an electrical conductor, the operator must jump clear **- he must NOT, under any circumstances, step down and allow part of his body to be in contact with the ground while any other part of this body is touching the machine.** Because of the hazardous voltage differential in the ground the operator should jump with his feet together, maintain balance and shuffle or hop slowly across the affected area. Do not take large steps because it is possible for one foot to be in a high voltage area and the other to be in a lower voltage area. The difference between the two can kill. Once safely away from the machine and conductors, the operator has the following responsibilities:

- Protect others by warning them and not allowing them to approach the energized equipment
- Call the Electric Utility for help, and to shut off the electric power
- Notify the appropriate Government Departments.

WRONG

RIGHT (BUT STILL DANGEROUS)
The operator should never leave the machine unless absolutely necessay.

6.3 Moving or Lifting Wires

High voltage wires or other equipment can be handled safely, only by someone who is trained and has special equipment and tools designed for high voltage. Never attempt to move or raise an electrical conductor with a board or stick. Never approach or touch an electrical conductor that is laying on the ground, it may be energized, or become energized. If possible, the area should be barricaded or guarded to prevent injury.

Only at household voltage levels (120 or 240 volts) and if a power source cannot be removed or turned off, can the victim be removed from an energized live circuit with the use of common insulating materials such as a dry leather belt.

7.0 FIRST AID

7.1 Care Of A Casualty If Injured

Once a victim is no longer in contact with electricity and medical help has been called, check the following:

Breathing - If victim is not breathing, use artificial respiration immediately. Every second counts.
Pulse - Check for pulse and begin CPR if required.
Shock - Signs include cold or clammy skin, weak, shallow breathing, rapid pulse. Loosen clothing, keep victim horizontal and warm until help arrives. Electric shock victims will often go into shock. Keep this in mind when transporting victim for medical attention. Cover with a blanket if one is available.
Burns - Avoid handling the affected area or removing burnt clothing. Don't use gauze, or any material that is likely to stick to the wound.

Always see a doctor even if there is no apparent injury as damage may occur to internal organs.

8.0 ATTACHMENTS

8.1 Crane and Hoist Signals

8.2 Excerpts from E.C.U.C. regarding activities performed near overhead power lines and excavation work in the vicinity of buried electrical cables. Excerpts from E.C.U.C. regarding interference with systems, moving equipment or buildings, amusement rides, high equipment and tree trimming.

8.3 Copy of the Province of Alberta Occupational Health and Safety Regulation & Code on the Protection of Workers and Hazard Assessment, Elimination and Control.

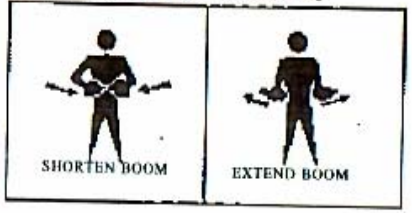
8.4 Copy of the Province of Alberta Occupational Health and Safety Code on Signallers.

Attachment 8.1

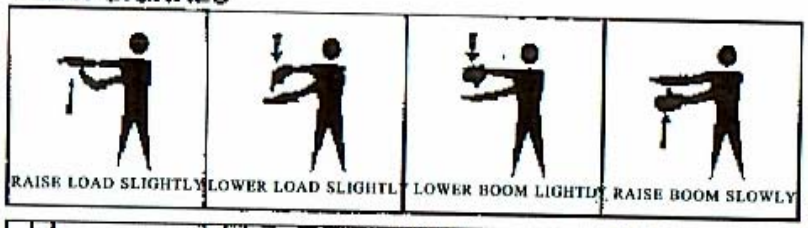
CRANE & HOIST SIGNALS

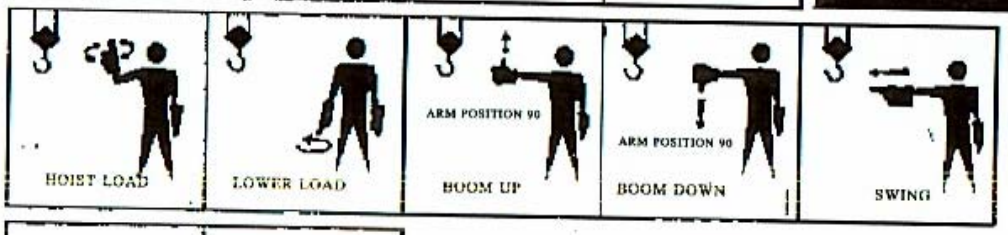
STOP SIGNALS

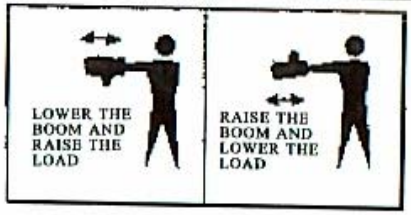
TELESCOPING BOOMS



SLOW SIGNALS







INSTRUCTIONS TO SIGNAL MEN

1. Only one person to be signalman
2. Make sure the Operator can see you and acknowledges the signal given
3. Signalman must watch the load-the Operator is watching you
4. Don't swing the load over the workers, warn them to keep out of the way

WATCH FOR OVERHEAD LINES OR OTHER OBSTRUCTIONS

EXCERPT FROM THE ELECTRICAL AND COMMUNICATION UTILITY CODE

Activities performed near overhead power lines

2-012

(1) This rule does not apply to the movement of persons, equipment, buildings or objects under overhead power lines or joint use communication lines if the height of the persons, equipment, buildings or objects remains constant but the requirements of rule 2-016 apply.

(2) A person and a person in charge of equipment of objects shall not approach, nor permit the equipment or objects to approach overhead powerlines closer than the safe limit of approach distances from overhead power lines specified in Table 2-1.

(3) Before work or other activity is commenced in the vicinity of an overhead power line the site shall be examined by the person in charge of the work or activity to establish that the safe limits of approach distances specified in Table 2-1 can be maintained.

(4) A person in charge of the work or other activity to be done in the vicinity of an overhead power line shall contact the operator of the overhead power line to ascertain the operating voltage of the line.

(5) If work or other activity is being carried out near the safe limits of approach distances specified in Table 2-1, the person in charge of the work or activity shall assign a person to act as an observer to ensure that the safe limit of approach distances will be maintained.

(6) Subrule (5) does not apply if an acceptable signalling system designed, engineered and constructed in accordance with industry standards is used to warn persons operating equipment that the equipment is approaching near to the safe limit of approach distance specified in Table 2-1.

(7) If work or other activity must be done in the vicinity of overhead powerlines at distances less than the safe limit of approach distance specified in Table 2-1 the following precautions shall be taken:

(a) the person or persons responsible for the work, activity or operation of equipment shall notify the operator of the overhead power line and request assistance.
(b) the operator of the overhead power line shall comply with the request for assistance as soon as possible, and
(c) the operator of the overhead power line shall provide assistance in accordance with the requirements of the safety rules.

(8) Subrules (2) to (7) do not apply to utility employees, qualified utility employees or utility tree trimmers performing work in accordance with the requirements of the safety rules.

(9) If the operating voltage of the overhead power line being approached by persons, equipment or objects is less than the design voltage of the line, the operating voltage may be used by utility employees to establish the safe limit of approach distance required by Table 2-1, and the design voltage shall be used for approach criteria by all other workers.

(10) If the operating voltage of the overhead power line being approached by persons, equipment or objects exceeds the operating voltage specified in Table 2-1 by more than 10% the safe limit of approach distance for the next higher voltage category shall be used.

(11) If the overhead power line being approached by persons, equipment, or objects is a single phase line the operating voltage if the line shall be multiplied by 1.73 to establish the equivalent operating voltage between conductors specified in Table 2-1.

(12) A person shall not place earth or other materials under or adjacent to an overhead power line if it reduces the clearance above ground for the power line required by this Code.

(13) A person shall not excavate or perform similar operations in the vicinity of an overhead power line if it reduces the support required for the power line.

TABLE 2-1
Safe Limit of Approach Distances from Overhead Power Lines for Persons and Equipment

Operating Voltage of Overhead Power Line Between Conductors	Safe Limit of Approach Distance for persons and Equipment
0 - 750 V Insulated or polyethylene Covered Conductors (1)	0.3 m
0-750 V Bare, Uninsulated	1.0m
Above 750 V Insulated Conductors (1)(2)	1.0 m
0.75 kV –40 kV	3.0 m
69 kV, 72 kV	3.5 m
138 kV, 144 kV	4.0 m
230 kV, 240 kV	5.0 m
500 kV	7.0 m

NOTES (1) Conductors must be insulated or covered throughout their entire length to comply with these groups.
(2) Conductors must be manufactured to rated and tested insulation levels.

Excavation work in the vicinity of underground power cables

2-018

(1) Before an excavation is started the person responsible for the excavation shall contact the operator of the electrical and communication utility systems in the area to ascertain whether underground power cables are present at the excavation site.

(2) Before an excavation is commenced the operator of underground utility cables located at the proposed excavation site shall identify and mark any underground power cables that could be interfered with when the excavation is undertaken.

(3) The person responsible for an excavation shall ensure that no excavation work is undertaken within 1 m of any underground utility cable unless:

(a) the excavation work is done under the control of the operator of the utility system, and
(b) the excavation work method is acceptable

EXCERPT FROM THE ELECTRICAL AND COMMUNICATION UTILITY CODE

Note: The operator of the underground cable is responsible for assuring that excavation and exposure of cables is done safely. The operator must determine if direct supervision is required or if the work will be done in a safe manner without direct supervision. This will depend on the reliability of the excavator and the type of installation involved.

Interference with systems
2-010
(1) No person shall interfere with, tamper with or wilfully damage electrical or communication utility systems covered by this Code.

(2) Electrical utility system poles and structures shall be kept free of all materials and equipment not required for the system, unless permitted by the operator of the utility system.

(3) No person shall make attachments to electrical utility system poles and structures unless authorization has been received from the operator of the utility system.

(4) No person shall climb electrical utility system poles or structures or make connections or disconnections to electrical utility system equipment unless the person has been authorized to do so by the operator of the utility system.

Moving equipment or buildings
2-016
(1)The operator of overhead power lines or communication lines shall ensure that the lines are installed and maintained to permit the safe movement under the lines of equipment, buildings or objects not exceeding the following height:

(a) 3.6 m for areas normally accessible to pedestrians only
(b) 4.1 m for driveways to residences or residential garages,
(c) 4.2 m for areas where agricultural equipment is normally used,
(d) 4.8 m for lanes, alleys or entrances to commercial or industrial premises,
(e) 5.3 m for roads and highways, and
(f) 5.4 m for right-of-way of underground pipelines.

(2) person shall not move equipment, a building, or an object under power lines or communication lines if it exceeds the height for the location prescribed by subrule (1), unless the requirements of subrule (3) are met

(3) If the height of the equipment, building or object exceeds the heights for locations prescribed by subrule (1), and the equipment, building or object must be moved under overhead power lines or communication lines the following precautions shall be taken:

(a) the person or persons responsible for moving the equipment, building or object shall contact the operator of the overhead lines before the move is begun and request assistance,
(b) the operator of the overhead lines shall comply with the request for assistance as soon as possible, and
(c) the operator of the overhead lines shall provide assistance in accordance with the requirements of the safety rules.

Amusement Rides and High Equipment
2-020

(1)The minimum clearance between and amusement ride or area where high equipment may be displayed and an overhead power line, measured horizontally between the nearest vertical planes formed by the amusement ride or the displayed equipment and the overhead power line shall be:

(a) the height of the amusement ride or displayed equipment, or 8 m whichever is the greater for overhead power lines operated at voltages above 750 V between conductors,
(b) as specified in clause (1) for overhead power lines with bare conductors operated at voltages below 750 V between conductors, and
(c) 3 m for overhead power lines with insulated or polyethylene covered conductors operated at voltages below 750 V between conductors.

Tree Handling
4-214

(1) Utility tree trimmers, utility tree workers and other workers performing tree work near energized electrical equipment or lines shall handle trees or portions of trees in accordance with procedures established by the employer, to prevent the trees or portions of trees being cut or trimmed from approaching the electrical equipment or lines closer than the tree to energized electrical equipment or lines distances specified in Tables 4-6 and 4-7.

Table 4-6
Tree to Energized Electrical Equipment or Lines Distances in Millimetres for Utility Tree Trimmers, Utility Tree Workers and Other Workers

Voltage Levels			Utility tree trimmers, utility tree worker s and other workers
Normal voltage to ground kV	Nominal voltage phase to phase kV	Maximum operating voltage phase to phase kV	Tree to energized electrical equipment or lines distance for slashing and brushing mm
Column 1	Column 2	Column 3	Column 4(1)
0.6 (DC only)			800
2.4	4.16	4.58	800
8	13.8	15.18	850
14.4	25	27.5	950
19.9	34.5	37.95	1050
	69.72	79.2	1350
	138.144	158.4	1650
	230,260	285	2150
	500	550	3460

Note: (1) Tree to energized electrical equipment or line distances in Column 4 have been calculated using IEEE tool distances plus s760 mm safety factor, rounded to the nearest 50 mm.

Protection of Workers

(h) "direct supervision" means under the supervision of a competent worker who is
- (i) personally and visually supervising the other worker, and
- (ii) able to communicate readily and clearly with the other worker;

General protection of workers

13(1) If work is to be done that may endanger a worker, the employer must ensure that the work is done
- (a) by a worker who is competent to do the work, or
- (b) by a worker who is working under the direct supervision of a worker who is competent to do the work.

(2) An employer who develops or implements a procedure or other measure respecting the work at a work site must ensure that all workers who are affected by the procedure or measure are familiar with it before the work is begun.

(3) An employer must ensure that workers who may be required to use safety equipment or protective equipment are competent in the application, care, use, maintenance and limitations of that equipment.

(4) If a regulation or an adopted code imposes a duty on a worker, the worker's employer must ensure that the worker performs that duty. AR 62/2003

Hazard Assessment, Elimination and Control

AOH&S Code, Part 2

Worker participation

8(1) If reasonably practicable, an employer must involve affected workers in the hazard assessment and in the control or elimination of the hazards identified.

(2) An employer must ensure that workers affected by the hazards identified in a hazard assessment report are informed of the hazards and the methods used to control or eliminate the hazards.

General Safety Precautions

AOH&S Code, Part 12

Signallers

191(1) If this Code requires signals to be given by a designated signaller, an employer must designate a competent worker to give the signals.

(2) An employer must ensure that, if the designated signaller uses hand signals, the signaller wears a highly visible vest, armlet or other piece of clothing that clearly identifies the worker as a designated signaller.

(3) A designated signaller using hand signals must wear the vest, armlet or other piece of clothing required by the employer under subsection (2).

(3) Before giving a signal to proceed, a designated signaller must ensure that there are no hazards in the vicinity.

(5) An equipment operator must take signals only from the designated signaller if a signaller is designated.
(6) An employer must ensure that only one designated signaller at a time gives signals to an equipment operator.

(7) Despite subsections (5) and (6), an equipment operator must take a " STOP" signal from a worker who is not a designated signaller.

(8) Despite subsections (5) and (6), if signals cannot be transmitted properly between a designated signaller and an equipment operator, an employer must ensure that

(a) additional designated signallers are available to transmit signals, or
(b) a means of ensuring clear and complete communication other than using designated signallers is provided.