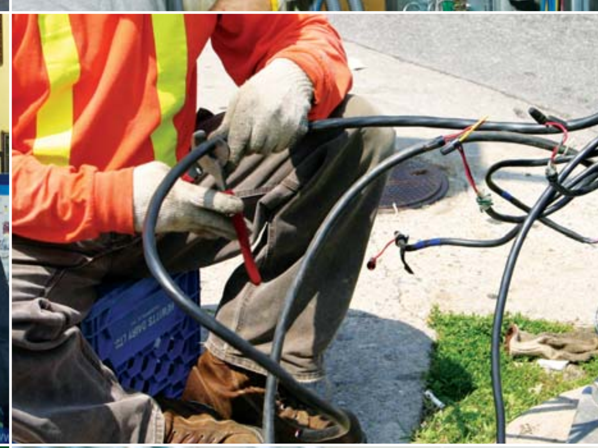
Electrician Ergonomic Research Study 2006

Prepared for Physicians & Health Care Providers

Trade Sectors:

- Industrial Commercial Institutional (ICI)
- Communication Sector
- Line, Utility & Traffic
- Highrise Residential
- Lowrise Residential



Research Papers Inside:

- Manual & Power Tools
- Low Back (slab)
- Heavy Cable Work
- Overhead Work
- Kneeling and Crouching
- Ladder Work
- Physical Demands Description (PPD's)

Patient Name: ______________________________

Electrician Ergonomic Research Study

Introduction by Joe Fashion
Business Manager

This research project is an important step forward in better understanding how work impacts your health as electrical workers. All of us have long suspected many of our aches and pains are work related - now we have the medical and ergonomic evidence explaining this connection.

Looking back, this Ergonomic Study is long overdue. The genesis of this study began with an understanding that the information we needed to address health and safety issues was inadequate. Current physical demands descriptions (PDD) on file were a number of years old and lacked a consistent structure that could be presented to health care professionals and appeals forums.

Updated PDDs, along with task analysis is useful in a number of ways. Consistent job descriptions, task analysis and PDDs in all sectors will enable union members and their health care professionals to better understand the physical demands normally experienced in various trade sectors.

Updated ergonomic literature will also enable supervision and health care professionals to better identify acceptable work for “back to work” placement after an injury. The literature can also be used to educate workers and employers, proactively reducing injury risk.

Upon receipt of this Ergonomic Study we ask your cooperation in bringing this report to your doctor at your next regularly scheduled appointment and request it be place in your patient file. Please tell your health care professional this is a union initiative. You can also keep this study and bring it along to a future appointment with your health care professional when you suspect an injury might be work related. The purpose of this study is to show health care professionals the physical demands of your job so they can make informed decisions.

Finally, I would like to express my gratitude to Gary Majesky who first proposed the concept and coordinated this project to completion. There is more work to be done and hopefully this report will shine a light for others to follow. As your business manager, it makes me very proud when do the right things for the right reasons. After reading this report, I’m sure you will agree - LU 353 is on the right track.

In solidarity

Joe Fashion

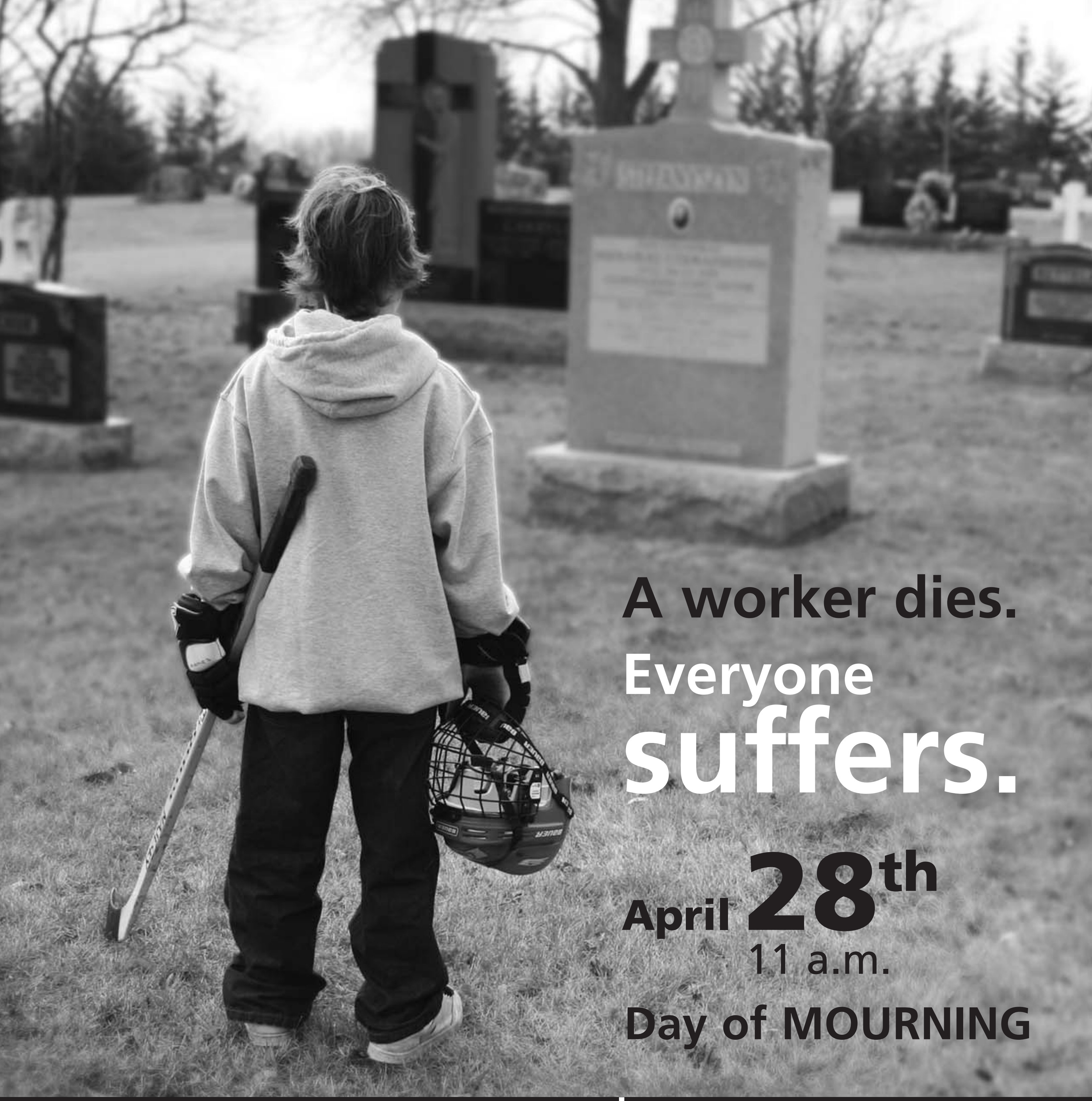
Electrician's Job Demands

Table of Contents

Research Papers (linking physical demands and injuries) Page

Physical Demands Descriptions (PDD's) Page

Additional Information Items Page



April 28th is dedicated to honouring the memory of those who have been injured or killed at work.

At 11 am, please stop working and observe one minute of silence.

In 2006, over 1000 workers died from workplace injury and disease.

LOCAL 353
INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS
TORONTO

Electrician's Job Demands

Manual & Power Tools

Research Study

Understanding the Physical Demands of an Electrician's Job

Electrician's Job Demands

Manual & Power Tools

An electrician's job is physical in nature, and the physical demands of the job are affected by the use of handheld manual and power tools such as hammers, pneumatic drills and other devices. These tools, however, are essential to the completion of an electrician's daily job activities. With increased use, comes the potential for injury.

During the month of April in 2005, the International Brotherhood of Electrical Workers (IBEW) local 353 commissioned the Toronto clinic of Occupational Health Clinics for Ontario Workers (OHCOW) to complete a musculoskeletal discomfort/symptom survey of its membership. OHCOW found that in the last year (at the time of survey), an average of 23.9% of reporting union members experienced work related aches, pain, discomfort or numbness of the elbow and 60.2% experienced work related aches, pain, discomfort or numbness of the hand and wrist that they believed to be work related. Of the reporting members, 16.2% had sought a health care professional's advice for elbow pain while 31.1% had sought a health care professional's advice for hand and wrist pain.

In a research article by Hanna et al. (2005) about the factors affecting absenteeism in electrical construction, 52% [of Electrician's] reported they had a work-related injury sometime during their career that caused them to miss work. Identifying potential mechanisms of injury within the job tasks of electrical work may prevent or lead to the reduction of work related injuries.

Mechanisms of Injury

There are three main injury mechanisms (McGill, 2002). Most individuals can identify the "specific incident" injury mechanism where a load greater than the individual's tissue tolerance is applied, resulting in an injury (Appendix). An injury may also occur from the continuous application of a load resulting in an injury from the reduction in an individual's tissue tolerance over time. The final injury mechanism involves repeated loading, which decreases an individual's tissue tolerance over time until an injury finally occurs (McGill, 2002).

Potential Injuries

NIOSH reported in 1997 that there is strong evidence for hand-arm vibration syndrome and repetitive strain injuries (RSIs) such as carpal tunnel syndrome, tendonitis, and epicondylitis in the elbow from a combination of repetition, force, production and awkward postures (Appendix).

RSIs are sometimes called cumulative trauma disorders and overuse injuries. RSIs result when a muscle, tendon, nerve or joint is stressed and traumatized on a repeated basis for days, months or years (OHCOW, 1998).

- Carpal Tunnel Syndrome:

  The carpal tunnel of the hand is a small space at the base of the palm formed by bones and ligaments of the wrist. Through this tunnel runs the median nerve, blood vessels and finger tendons. When the median nerve in this structure is compressed, perhaps because of swelling from overuse, carpal tunnel syndrome results (OCHOW, 1999).

- **Tendonitis:**

  A tendon is a group of tough elastic fibres that connect muscle to bone in the body. Repetitive movements of the wrist and forearm can cause a muscle tendon to become inflamed and painful. When this occurs, the condition is called tendonitis (OHCOW, 1999).

- **Epicondylitis:**

  Epicondylitis is a condition where the outer part of the elbow becomes painful and tender, usually as a result of a specific strain, overuse, or a direct blow.

  The most common cause of epicondylitis is over use of the wrist extensor muscles which are attached to the bone at this part of the elbow. If the wrist extensors are strained or over used they become swollen, painful and tender to touch (Medinfo, 2004).

- **Hand Arm Vibration Syndrome:**

  Hand-arm vibration syndrome (HAVS) is a disease that involves circulatory disturbances, sensory and motor disturbances and musculoskeletal disturbances. It is caused by daily exposure to hand and arm vibration by workers who use vibrating tools such as jackhammers and drills, which can cause physical damage to the hands and arms resulting in tingling and numbness in the fingers, loss of grip strength and spasms (OHCOW, 1998).

Manual & Power Tool Use

Electrician's use a variety of handheld manual and power tools such as screwdrivers, pliers, cutters, drills, hammer drills, saws, etc. A majority of the work conducted using handheld tools involves contact with cement and wood, which may include drilling, screwing or other manipulation methods.

Workers, supervisors and employers must be aware that many factors affect the ergonomics associated with tool use in the electrical trade. Physical factors such as temperature, tool design and job task alter the forces and physical mechanics of a job.

Manual tools are used frequently in the electrical trade. As stated in previous paragraphs, repetitive use increases the risk of injury. Many manual tools, such as hammers and screwdrivers, place a worker’s wrist in an undesirable, non-neutral position (Leamon et al., 1994). Leamon et al. (1994) also showed that straight handled pliers, which place the wrist into ulnar deviation, were correlated with wrist related disorders. Continuous flexion of the wrist with manual tool use may also contribute to the development of carpal tunnel syndrome and increase fatigue, which may lead to other injuries.

Hammers were also reported to cause impact loading in the wrist (Leamon et al., 1994) and were responsible for eccentric loading in the forearm musculature. Straight-handed screwdrivers were also found to place the wrist in an awkward posture, which can increase the chance of developing a wrist injury (Hagberg et al., 1995).

Hand-held power tools can also contribute to worker injuries. Research by Kihlberg et al. (1996) and Barton (1997) reported incidences of carpal tunnel, tendonitis, vibration white finger and ganglionic cysts from prolonged power tool use. Vibration from power tools is especially problematic, as it reduces sensory feedback in the fingers (Chengalur et al., 2004). Reduced sensory information can cause a worker to increase force output, such as their grip force on the tool, increasing the potential for injury. Vibration from handheld power tools can also potentially cause microfractures in the forearm or hand (Kihlberg et al., 1996). Lastly, if a worker is required to use a tool that vibrates while their hands are cold, the risk of injury to the hand and forearm increases substantially (Astrand et al., 1986).

For both manual and power hand tools, pressure points of > 22psi or 150 kPa stemming from tool use increase user discomfort and may potentially press on blood vessels decreasing blood flow or blocking nerves, especially at the base of the hand (Chengalur et al., 2004).

Temperature:

Weather, more specifically ambient temperature, is a factor in most electrical work as much of an electrician's work is completed in unfinished buildings. For example, temperatures below 0 degree Celsius can cause vasoconstriction of the arteries in the hand, which diminishes blood flow. Decreased blood flow reduces oxygen flow to the muscles required to pinch, grip or hold tools or electrical components, leading to muscular fatigue and potential injury (Astrand et al., 1986). Although gloves can provide protection from the elements, they also reduce hand dexterity and gloves also increase the amount of force an individual has to produce in order to complete a job. This increase in force raises the potential for a musculoskeletal disorder (MSD) with repetitive or continuous use.

Tool Design:

Tool design plays a large role in the augmentation of workplace ergonomics. Chengalur et al. (2004) highlighted the importance of designing tools to utilize the largest muscle group to complete a task. For example, if a worker were required to dig a hole during meter base installation, a shovel edge with an area large enough for the foot would allow the worker to employ their quadriceps muscles to push the shovel into the earth. If the shovel only allowed enough area for the toe, the worker would rely on the smaller muscles of the calf to push the shovel into the earth, requiring the same amount of force from a smaller muscular group, increasing the risk of injury.

Chengalur et al. (2004) listed the following points for good tool design:

- Make handle diameters 3.75cm and the span on double-handled tools from 5 to 6.25cm
- Make handles about 10cm long to avoid pressure to the base of the hand
- Orient the tool so it can be used with a neutral wrist posture
- Design the tool with textured handles to reduce excess force production from cold or wet environments
- Reduce tool vibration as much as possible

Job Tasks:

A required component of an electrician's job is overhead work. Overhead work places an electrician's shoulders in an awkward, far reaching position, increasing the forces on the shoulder capsule and musculature. Repetition or continuous work in an overhead position increases the potential for a shoulder injury (CCOHS, 2005). Overhead work or work involving stripped materials, such as stripped fastening screws, also require increased muscular force production, which further complicates the potential for injury due to increased joint loading during force production (Lin et al., 2003).

Repetition:

Workers, supervisors and employers should also be aware that current research does not define low or high levels of repetition. According to the Canadian Center for Occupational Health and Safety (CCOHS) (2005), "Some researchers classify a job as "high[ly] repetitive" if the time to complete such a job is less than 30 seconds" and the cycle is repeated for two hours or more (Chengalur et al., 2004). With respect to electrical work, a larger task such as 'installing switches' may be broken down into component parts to determine the time associated with each subtask. This may allow for each subtask to be compared to the CCOHS statement. CCOHS (2005) also states "Although no one really knows at what point MSDs may develop, workers performing repetitive tasks are at risk for MSDs." The effect of repetition is also worsened if the individual is working in an awkward posture or is using increased force. As such, potential risks should be examined.

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)

Supervised by: Syed Naqvi – PhD, CCPE, CPE (Ergonomist, OHCOW Inc.), Carrie Edgeworth – BSc, Hon. Kin. (Ergonomist. OHCOW Inc.) & Gary Majesky (IBEW L.U. 353)

Appendix

Injury Mechanisms (McGill, 2002)

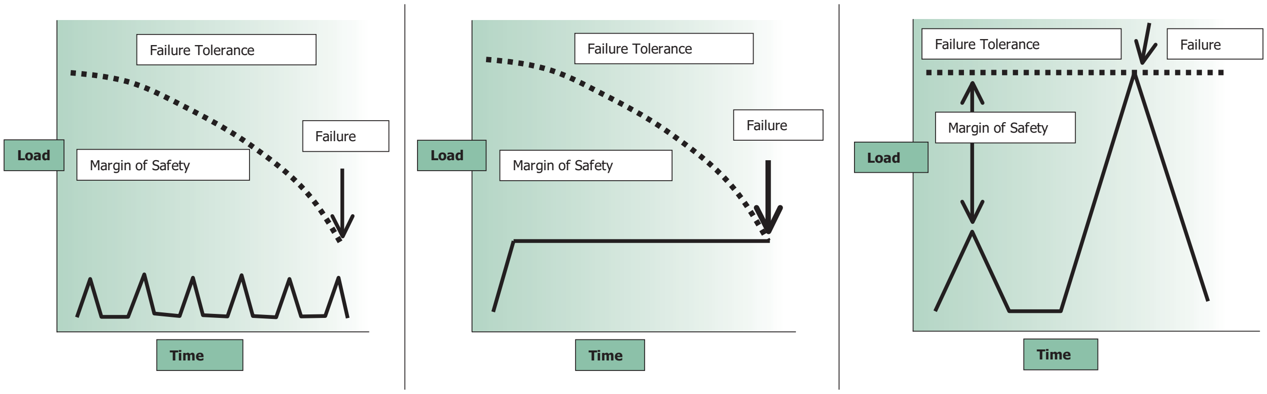


Table 1. Evidence for causal relationship between physical work factors and MSDs

Body part *Risk factor*	**Strong evidence (+++)**	**Evidence (++)**	**Insufficient evidence (+/0)**	**Evidence of no effect (-)**
Neck and Neck/shoulder				
Repetition		✓		
Force		✓		
Posture	✓			
Vibration			✓	
Shoulder				
Posture		✓		
Force			✓	
Repetition		✓		
Vibration			✓	
Elbow				
Repetition			✓	
Force		✓		
Posture			✓	
Combination	✓			
Hand/wrist				
Carpal tunnel syndrome				
Repetition		✓		
Force		✓		
Posture			✓	
Vibration		✓		
Combination	✓			
Tendinitis				
Repetition		✓		
Force		✓		
Posture		✓		
Combination	✓			
Hand-arm vibration syndrome				
Vibration	✓			

Source: NIOSH, 1997

References

Astrand, P.O., Rodahl, K., Dahl, H. & Stromme, S.B. (1986).
Textbook of Work Physiology: Physiological Bases of Exercise. Ontario: Human Kinetics.

Barton, A. (1997). Hand injury and electrical tools.
Work: A Journal of Prevention, Assessment & Rehabilitation, 10, 71-75.

Canadian Center for Occupational Health and Safety (2002, June 12).
How does repetitiveness and pace of work influence WMSDs?
Retrieved May 25, 2006, from http://www.ccohs.ca/oshanswers/ergonomics/risk.html

Chengalur, S.N., Rodgers, S. & Bernard, T. (2004).
Kodak's Ergonomic Design for People at Work. New York: John Wiley & Sons, Inc.

Hagberg, M., Silverstein, B., Wells, R., Smith, M., Hendrick, H., Carayon, P. & Perusse, M. (1995).
Work Related Musculoskeletal Disorders (WMSDs): A Reference Book for Prevention. Great Britain: Taylor & Francis.

Hanna, A. S., Menches, C.L., Sullivan, K.T. & Sargent, J. (2005). Factors affecting absenteeism in electrical construction.
Journal of Construction Engineering and Management, 131, 1212-1218.

Kihlberg, S. & Hagberg, M. (1997). Hand-arm symptoms related to impact and nonimpact hand-held power tools.
International Archives of Occupational Environmental Health, 69, 282-288.

Leamon, T.B. & Dempsey, P.G. (1995). The unusual congruence between subjective evaluations and losses associated with inadequate hand tool design.
International Journal of Industrial Ergonomics, 16, 23-28.

Lin, J.H., Radwon, R.G., Fronczak, F.J. & Richard, T.G. (2003). Forces associated with pneumatic screwdriver operation: statics and dynamics.
Ergonomics, 46, 1161-1177.

McGill, S. (2002).
Low Back Disorders: Evidence-Based Prevention and Rehabilitation. Ontario: Human Kinetics.

Medinfo (2004, November 7).
Tennis Elbow (Lateral Epicondylitis).
Retrieved July 12, 2006 from http://www.medinfo.co.uk/conditions/tennis elbow.html

Musculoskeletal Disorders and Workplace Factors: *A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back, U.S. Department of Health and Human Services,* 2nd printing. (1997).

Occupational Health Clinics for Ontario Workers (2006).
Discomfort Survey Results.
Retrieved August 3, 2006 from http://www.ibew353.org/survey%20results.pdf

Occupational Health Clinics for Ontario Workers (1998, December).
Hand Arm Vibration Syndrome.
Retrieved July 12, 2006 from http://ohcow.on.ca/resources/handbooks/havs/HAVS.htm

Occupational Health Clinics for Ontario Workers (1999, November).
Work Related Musculoskeletal Disorders (WSMDs).
Retrieved July 12, 2006 from http://ohcow.on.ca/resources/handbooks/wrmd/WRMD.htm

Membership Report - 2006

The results of the Occupational Health Clinic held at the union hall on April 23/05 are in. In total, 400 members took part in the clinic when we added the participants from the June 2004 intake clinic at the CNE. 81% of the participants were ICI workers; 58.2% had greater than 10 years experience; 53% were age 50 years old and older; and 47% were retired members.

Chemical/physical hazards were reported showing:

- **82% had been exposed to asbestos**
- **84% had been exposed to cutting oils**
- **82% had been exposed to fibreglass**
- **72% had been exposed to PCB's**

Surprisingly missing from this section was silica or cement dust, as we all use drills and hammer drills to mount most boxes, pipe and panels. In the musculoskeletal section we fell right in line with other studies concerning the breakdown of our bodies due to work related injuries. A study from the U.S.A reported 860,000 occupational related illness in 1998 and 60,300 deaths due to occupational illness. In this study they report on average that 60% were musculoskeletal disorders. The LU 353 study mirrored the findings of this study and confirms we are experiencing similar findings within our own jurisdiction in 6 key areas:

- **Lower Back - 67%**
- **Knee's - 67%**
- **Right wrist/hand - 63.8%**
- **Left wrist/hand - 56.6%**
- **Shoulders - 54.3%**
- **Neck - 49.3%**

Occupational Health Clinic, April 23/05

The key factors that cause musculoskeletal disorders were listed as repetition, force, awkward or static posture, vibration, work speed and restricted tasks. In general this is also how many of our members reported their job duties, also throwing in overhead work, ladder work and confined work spaces.

The results show that many of our members experience repetitive strain injuries due to damage to body soft tissues. These if left untreated result in further injuries or diseases, such as Carpal Tunnel Syndrome, Epicondylitis (tennis elbow), Rotator Cuff damage and cervical strain to name a few.

(Continued on page 34)

Electrician's Job Demands

Low Back (Slab)

Research Study

Understanding the Physical Demands of an Electrician's Job

Electrician's Job Demands

Low Back (Slab)

An electrician's job is physical in nature, and physical job demands are affected by postures employed and environmental factors. A main task of high-rise residential electrical work sector is called "slab work". Slab work's main task involves installing conduit and securing it to rebar via metal ties. As an electrician can be placed on a team that does slab work for years, the workers are at risk of developing a spinal injury.

During the month of April in 2005, the International Brotherhood of Electrical Workers (IBEW) local 353 commissioned the Toronto clinic of Occupational Health Clinics for Ontario Workers (OHCOW) to complete a musculoskeletal discomfort/ symptom survey of its membership. OHCOW found that in the last year (at the time of survey), 67% of reporting union members experienced work related aches, pain, discomfort or numbness of the low back. Of the reporting members, 37.8% had sought a health care professional's advice for low back pain.

In a research article by Hanna et al. (2005) about the factors affecting absenteeism in electrical construction, 52% [of Electrician's] reported they had a work-related injury sometime during their career that caused them to miss work. Identifying potential mechanisms of injury within the job tasks of electrical work may prevent or lead to the reduction of work related injuries.

Mechanisms of Injury

There are three main injury mechanisms (McGill, 2002). Most individuals can identify the "specific incident" injury mechanism where a load greater than the individual's tissue tolerance is applied, resulting in an injury (Appendix). An injury may also occur from the continuous application of a load resulting in an injury from the reduction in an individual's tissue tolerance over time. The final injury mechanism involves repeated loading, which decreases an individual's tissue tolerance over time until an injury finally occurs (McGill, 2002; Marras, 2003).

Potential Injuries

Disc degeneration:

Disc degeneration is one of the leading causes of spine instability and is caused by excessive wear and tear on the spine resulting in disc tearing, loss of height and nucleus degradation (Kumar, 2001). These changes alter the ability of the disc to withstand compression and shear forces, which in turn greatly alters the spine's ability to stabilize itself (Furman & Simon, 2006).

Disc herniation:

Disc herniation occurs from repeated flexion or from full flexion with lateral bending and twisting (McGill, 2002). Disc herniation is a condition in which part of or the entire disc nucleus leaks through a weak portion of the disc and presses on the spinal nerves causing leg and back pain (Furman & Simon, 2006).

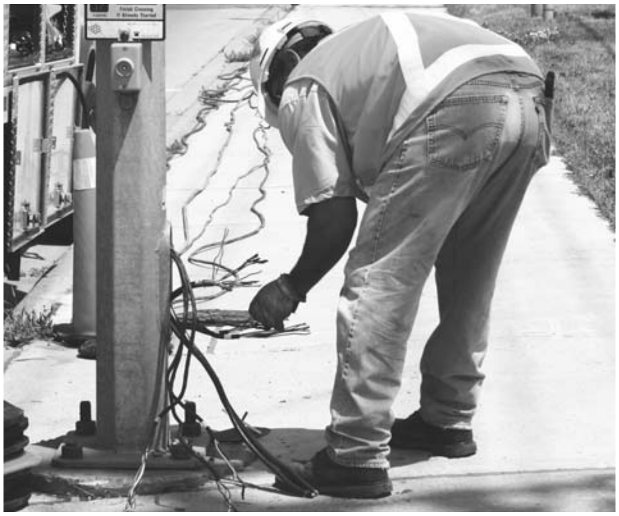
Endplate fracture:

An endplate fracture occurs when a vertebral endplate cracks as a result of excessive compressive pressure. The endplate is a permeable membrane which allows the transport of nutrients and wastes into and out of the cell. The disc that rests on the vertebral endplate may eventually leak through the crack causing pain, lack of mobility, swelling, etc (McGill, 2002).

Risk Factors for Injuries

Spinal Composition:

The spine is composed of cervical, thoracic, lumbar, sacral and coccyx vertebrae. This review is specifically examining the lumbar spine, also referred to as the low back. The low back is made up of five lumbar vertebrae. Vertebrae are round bodies of cortical bone with projections (spinal processes) that allow for muscle and tendon attachment. The top and bottom of each vertebral body (endplate) is porous, allowing for nutrients and wastes to pass through (McGill, 2002).



Between each vertebral body are intervertebral discs. The discs are gel-like in composition and assist the vertebral bodies in withstanding compression and shear forces. The disc nucleus is surrounded by annulus fibres (Appendix) that wrap around the nucleus like layers on an onion (McGill, 2002).

Slab Work:

Research indicates that static lumbar flexion is considered a risk factor for low back disorders. Chengalur et al. (2004) reported that awkward posture is strongly associated with low back injuries, while static posture and compression are good risk factors for low back injuries. Workers who maintain static lumbar flexion for prolonged periods of time also experience high rates of low back disorders (Olson et al., 2004). Cheung et al. (2003) wrote that prolonged static loads may cause disc degeneration by limiting transfer of nutrients and wastes from the spinal discs. As such, occupations with cumulative loading have increased injury risk (Marras, 2003).

Prolonged flexion also causes creep in the intervertebral discs. Creep is the deformation of the intervertebral disc from constant loading. With forward flexion of the spine, the disc will deform, moving posteriorly towards the back of the spinal column (McGill & Brown, 1992). A model for creep developed by Solomonow et al. (2003) predicts that full recovery of creep may take up to 48 hours (Olson et al., 2004). McGill & Brown's (1992) research found that recovery time for creep increases as an individual ages. Therefore older workers may be at further risk of a low back injury. This would also place slab workers at increased risk for injury during weekdays, as there is a maximum of 16 hours of rest between shifts. Olson et al. (2004) also reported that creep resulted in spasms of back musculature and changes in muscle activity of the spine, further increasing worker risk of incurring a low back injury.

Trunk flexion generates large compressive loads on the low back and passive tissues from muscular forces (Dickey et al., 2003). Static flexion of the trunk can result in flexion-relaxation phenomenon (Dickey et al., 2003). Flexion-relaxation phenomenon occurs when the trunk is flexed anteriorly. The EMG activity of the spinal musculature in the low back decreases to zero as the trunk flexion angles increase, resulting in the passive tissues of the spine bearing the external load (Olson et al., 2004; Dickey et al., 2003). Without muscular support, the spine is at greater risk for injury.

A Physical Demands Description completed for the high-rise residential sector of electrical work revealed that workers maintain a flexed trunk posture for more than 50% of their job. When examining slab work individually, a worker maintains a flexed posture for more than 90% of the task. Informal questioning of high-rise Electrician's on site revealed that workers could be placed on slab for months and even years. Slab workers are therefore working in a prolonged static posture.

Spinal musculature is capable of producing large amounts of force due to its cross-sectional area and its line of action. Spinal musculature best protects the spine and its components from compression and shear forces when it is in a neutral orientation. Spinal flexion alters the advantageous muscular line of action decreasing the muscles' ability to withstand shear and compression forces, which increases the risk of a spinal injury (McGill, 2002). Therefore, when working, a neutral spine for maximum ability to withstand shear and compression forces is recommended. A fully flexed spine, like that of an electrician doing slab work increases shear loading of the spine and ligament damage, causing spine instability. According to McGill (2002) the best method for spinal injury prevention is to build job variability into a worker's tasks and maintain a neutral spine, both of which are currently lacking in high-rise residential work.

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)

Supervised by: Syed Naqvi – PhD CCPE CPE (Ergonomist, OHCOW Inc.), David Mijatovic – BSc MHSc (Ergonomist, OHCOW Inc.) & Gary Majesky (IBEW L.U. 353)

Appendix

Injury Mechanisms (McGill, 2002)

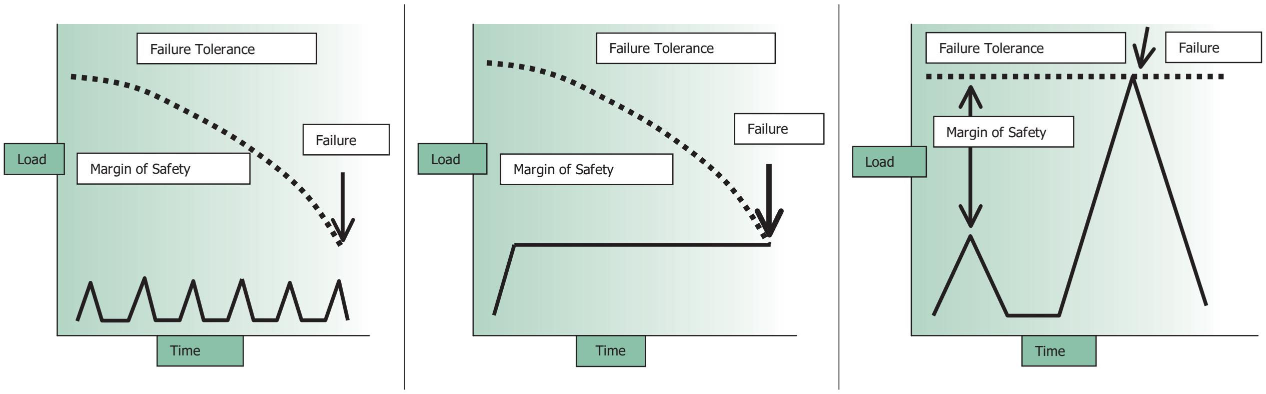


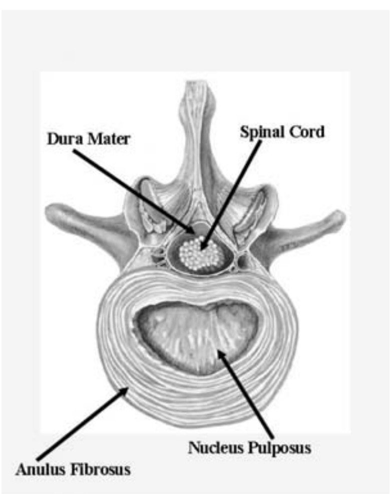
Table 1 (Chengalur et al., 2004)

Primary Job Risk factors Considered in Major Reviews

Risk Factor	Low Back	Distal Upper Extremities	Neck and Shoulders
Force	Strong	Strong	Strong
Awkward Posture	Strong	Strong	Strong
Static Posture	Good	Good	Good
Repetition	Good	Strong	Strong
Dynamic Factors	Good	Weak	Weak
Compression	Good	Weak	Weak
Vibration	Strong	Strong	Weak
Combined	Good	Strong	Good

Strong = strongly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders
Good = strongly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders
Weak = weakly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders

Spinal Disc & Vertebrae (Ithica University, 2006)



References

Canadian Center for Occupational Health and Safety (1997, December 16). *Back Injury Prevention.* Retrieved July 17, 2006, from http://www.ccohs.ca/oshanswers/ergonomics/inj_prev.html

Chengalur, S.N., Rodgers, S. & Bernard, T. (2004). *Kodak's Ergonomic Design for People at Work*. New York: John Wiley & Sons, Inc.

Cheung, J., Zhang, M. & Chow, D. (2003). Biomechanical Responses of the Intervertebral Joints to Static and Vibrational Loading: A Finite Element Study. *Clinical Biomechanics*, 18, 790-799.

Dickey, J., McNorton, S. & Potvin, J. (2003). Repeated Spinal Flexion Modulated the Flexion-Relaxation Phenomenon. *Clinical Biomechanics*, 18, 783-789.

Furman, M. & Simon, J. (2006, January 3). *Cervical Disk Disease*. Retrieved July 17, 2006, from http://www.emedicine.com/pmr/topic25.htm

Hanna, A. S., Menches, C.L., Sullivan, K.T. & Sargent, J. (2005). Factors affecting absenteeism in electrical construction. *Journal of Construction Engineering and Management*, 131, 1212-1218.

Hagberg, M., Silverstein, B., Wells, R., Smith, M., Hendrick, H., Carayon, P. & Perusse, M. (1995). *Work Related Musculoskeletal Disorders (WMSDs): A Reference Book for Prevention*. Great Britain: Taylor & Francis.

Marras, W. (2003). The Case for Cumulative Trauma in Low Back Disorders. *The Spine Journal*, 3, 177-179.

McGill, S. (2002). *Low Back Disorders: Evidence-Based Prevention and Rehabilitation*. Ontario: Human Kinetics.

McGill, S. & Brown, S. (1992). Creep Response of the Lumbar Spine to Prolonged Full Flexion. *Clinical Biomechanics*, 7, 43-46.

Musculoskeletal Disorders and Workplace Factors: *A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back, U.S. Department of Health and Human Services*, 2nd printing. (1997).

Occupational Health Clinics for Ontario Workers (2006). *Discomfort Survey Results*. Retrieved August 3, 2006 from http://www.ibew353.org/survey%20results.pdf

Olson, M., Li, L. & Solomonow, M. (2004). Flexion-Relaxation Response to Cyclic Lumbar Flexion. *Clinical Biomechanics*, 19, 769-776.

Electrician's Job Demands

Heavy Cable Work

Research Study

Understanding the Physical Demands of an Electrician's Job

Heavy Cable Work

Heavy cable lifting is a main component of electrical work with distinct physical effects on the body. According to Hanna et al. (2005) in a research article about the factors affecting absenteeism in electrical construction, 52% [of Electrician's] reported they had a work-related injury sometime during their career that caused them to miss work.

During the month of April in 2005, the International Brotherhood of Electrical Workers (IBEW) local 353 commissioned the Toronto Clinic of the Occupational Health Clinics for Ontario Workers (OHCOW) to complete a musculoskeletal discomfort/ symptom survey of its membership. OHCOW found that in the last year (at the time of survey), an average of 50.35% of reporting union members experienced work related aches, pain, discomfort or numbness of the shoulder while 67% of reporting union members experienced work related aches, pain, discomfort or numbness of the low back. Of the reporting members, 31.4% had sought a health care professional's advice for shoulder pain while 37.8% had sought a health care professional's advice for low back pain.

Mechanisms of Injury

There are three main mechanisms of injury (McGill, 2002). Most individuals can identify the "specific incident" injury mechanism where a load greater than the individual's tissue tolerance is applied, resulting in an injury (Appendix). An injury may also occur from continuous load application resulting in an injury from the reduction in an individual's tissue tolerance over time. The final injury mechanism involves repeated loading, which decreases an individual's tissue tolerance over time until an injury finally occurs (McGill, 2002).

Potential Injuries

In certain sectors, Electrician's handle large cable, such as 500 MCM, which can weigh over 7.5 Kg a meter. Many Electrician's in Local 353 refer to working with 500 MCM tech cable as "wrestling a python." Working with heavy cable increases the risk for a low back or shoulder injury due to the unstable and unpredictable nature of the cable (Gallagher et al., 2002).

Musculoskeletal Disorders of the Low Back and Shoulder:

The National Institute of Occupational Health and Safety (NIOSH) (1997) defines musculoskeletal disorders (MSDs) as a condition that involves the nerves, tendons, muscles, and supporting structures of the body. An MSD may cause pain, inflammation, reduced mobility as well as other symptoms. Chengalur et al. (2004) reported that awkward posture is strongly associated with low back injuries, while static posture and compression are good risk factors for low back injuries. Workers who maintain static lumbar flexion for prolonged periods of time also experience high rates of low back disorders (Olson et al., 2004). The NIOSH action limit for the spine is 3400 N. A study by Gallagher et al. (2002) found that average compression values for tested heavy cable lifting tasks exceeded the NIOSH action limit, placing the spine at risk for a musculoskeletal injury.

NIOSH (1997) states that repeated or sustained shoulder flexion and abduction greater than 60 degrees from neutral is positively associated with shoulder MSDs and shoulder tendonitis. When the shoulder nears its end range of motion in overhead work settings, stretching and compression of tendons and nerves occurs limiting blood flow to the joint and damaging tissues. The longer a fixed or awkward body position is held, the greater the risk of developing MSDs (CCOHS, 2002).

Risk Factors for Injuries

There is great similarity in heavy cable work performed by Electrician's and miners. In both cases, Electrician's and miners often work with heavy cable in physical environments that prevent a neutral spine posture from being used. Therefore the workers usually adopt a stooped or kneeling posture, which greatly increases the risk of incurring a spinal injury (Gallagher et al., 2002; McGill, 2002). Researchers believe that workers may choose to adopt a stooped posture because it allows them to recruit muscular motor units in the leg, allowing the workers to create more physical force to support a load. Although the increase in muscular force allows an electrician to support a greater amount of weight, stooping involves deep trunk flexion, increasing the compressive and shear forces on the spine due to the increase in weight being handled (Gallagher et al., 1988). To decrease the risk of a low back injury, a single electrician should lift less cable or the work should be completed with two or more workers.

Gallagher et al. (1988, 1997, 2002) examined the effect of heavy cable lifting while in a kneeling posture. A kneeling posture limits the use of the leg musculature in the force production required to lift heavy cable. A kneeling posture also decreases mobility, causing workers to use spinal torsion (twisting) in order to accomplish tasks. Frequent torso motion and spinal deviations are low back injury risk factors. The spine's load bearing is also reduced when in a twisted position further complicating the spine's risk of injury (McGill, 2002).

With larger wiring jobs, an electrician is required to install and lift heavy cable in bigger quantities. The increase in weight associated with lifting more cable increases spinal musculature recruitment, increasing the risk of a low back MSD. Heavy cable is also unstable and prone to moving about. Therefore an electrician must also exert more force to stabilize him/herself and the cable, increasing muscular recruitment, which again, increases MSD risk (Gallagher et al., 2002).

When installing heavy cable, an electrician will eventually need to hold the cable in place with one arm in order to secure it with the other causing asymmetry of movement (Kingma & Dieen, 2004). Asymmetrical lifting movement increases spinal compression, increasing the risk for a spinal injury and also places more load on the shoulder further increasing the shoulder's risk of injury (Marras & Davis, 1998).

It is also important to note that the greater the force required to sustain a posture or lift heavy cable, the quicker an individual will become fatigued (Hagberg et al., 1995). Therefore, as the amount of heavy cable lifted increases, an individual may become more fatigued increasing the risk of a low back or shoulder injury. Hagberg et al. (1995) also noted that the longer a static posture is held, the greater the need for recovery time between work activities or work shifts.

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)

Supervised by: Syed Naqvi – PhD CCPE CPE (Ergonomist, OHCOW Inc.), David Mijatovic – BSc MHSc (Ergonomist, OHCOW Inc.) & Gary Majesky (IBEW LU 353)

Appendix

Injury Mechanisms (McGill, 2002)

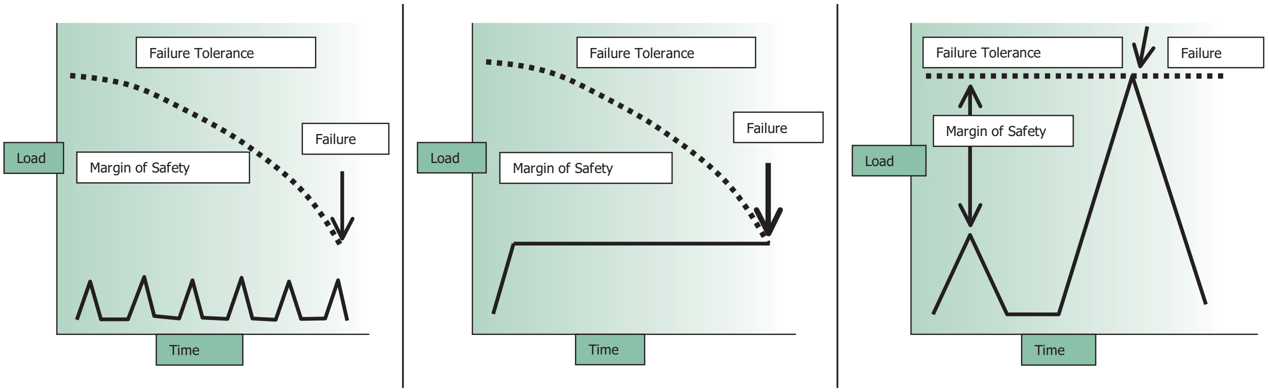


Table 1 (Chengalur et al., 2004)

Primary Job Risk Factors Considered in Major Reviews

Risk Factor	Low Back	Distal Upper Extremities	Neck and Shoulders
Force	Strong	Strong	Strong
Awkward Posture	Strong	Strong	Strong
Static Posture	Good	Good	Good
Repetition	Good	Strong	Strong
Dynamic Factors	Good	Weak	Weak
Compression	Good	Weak	Weak
Vibration	Strong	Strong	Weak
Combined	Good	Strong	Good

Strong = strongly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders
Good = strongly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders
Weak = weakly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders

Table 2: Static Work Duration as a Function of Intensity
(Rodgers et al., 1986)

Percent of Maximum Static Strength	Maximum Endurance Time
100	6 seconds
75	21 seconds
50	1 minute
25	3.4 minutes
15	>4 minutes

Recovery Time Needs for Three Levels of Effort for Different Effort Durations
(Rodgers 1998)

Effort time plus recovery time is the time before repeating to avoid accumulating fatigue on a task.

Continuous Effort Time (seconds)	Recovery Time Needed for Nonfatiguing Work (seconds)		
	Heavy	Moderate	Light Effort
1	1	1	0
2	3	2	1
3	4	2	1
4	9	3	1
5	14	3	1
6	18	4	1
7	27	5	1
8	35	8	1
9	49	11	1
10	57	14	2
11	62	17	2
12	74	20	3
13	97	24	3
14	111	28	3
15	135	32	3
16	149	36	3
17	158	43	3
18	167	48	4
19	186	53	4
20	220	57	5
21		62	5
22		67	5
23		73	5
24		79	5
25		86	5
30			11
35			13
40			15
45			17
50			20
55			25
60			40

Source: Chengalur et al., 2004

References

Canadian Center for Occupational Health and Safety (2005, December 12).
Work Related Musculoskeletal Disorders.
Retrieved August 1, 2006, from http://www.ccohs.ca/oshanswers/diseases/rmirsi.html

Chengalur, S.N., Rodgers, S. & Bernard, T. (2004).
Kodak's Ergonomic Design for People at Work. New York: John Wiley & Sons, Inc.

Gallagher, S., Hamrick, C., Cornelius, K. & Redfern, M. (2001).
The Effects of Restricted Workspace on Lumbar Spine Loading. Occupational Ergonomics, 2, 201-213.

Gallagher, S., Hamrick, C. & Love, A. (1997). Biomechanical Modelling of Asymmetric Lifting Tasks in Constrained Lifting Postures.
Ergonomics and Musculoskeletal Disorders: Research on Manual Materials Handling, 86-90.

Gallagher, S., Marras, W. & Bobick, T. (1988). Lifting in Stooped and Kneeling Postures: Effects on Lifting Capacity, Metabolic Costs, and Electromyography of Eight Trunk Muscles.
International Journal of Industrial Ergonomics, 3, 65-76.

Gallagher, S., Marras, W., Davis, K. & , K. (2002). Effects of Posture on Dynamic Back Loading During a Cable Lifting Task.
Ergonomics, 45, 380-398.

Hagberg, M., Silverstein, B., Wells, R., Smith, M., Hendrick, H., Carayon, P. & Perusse, M. (1995).
Work Related Musculoskeletal Disorders (WMSDs): A Reference Book for Prevention.
Great Britain: Taylor & Francis.

Hanna, A. S., Menches, C.L., Sullivan, K.T. & Sargent, J. (2005). Factors affecting absenteeism in electrical construction.
Journal of Construction Engineering and Management, 131, 1212-1218.

Hagberg, M., Silverstein, B., Wells, R., Smith, M., Hendrick, H., Carayon, P. & Perusse, M. (1995).
Work Related Musculoskeletal Disorders (WMSDs): A Reference Book for Prevention.
Great Britain: Taylor & Francis.

Kingma, I. & Dieen, J. (2004). Lifting Over an Obstacle: Effects of One-Hand Lifting and Hand Support on Trunk Kinematics and Low Back Loading.
Journal of Biomechanics, 37, 249-255.

Marras, W. & Davis, K. (1998). Spine Loading During Asymmetric Lifting Using One Versus Two Hands.
Ergonomics, 41, 817-834.

McGill, S. (2002).
Low Back Disorders: Evidence-Based Prevention and Rehabilitation. Ontario: Human Kinetics.

Musculoskeletal Disorders and Workplace Factors:
A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back, U.S. Department of Health and Human Services, 2nd printing. (1997).

Occupational Health Clinics for Ontario Workers (2006).
Discomfort Survey Results.
Retrieved August 3, 2006 from http://www.ibew353.org/survey%20results.pdf

Olson, M., Li, L. & Solomonow, M. (2004). Flexion-Relaxation Response to Cyclic Lumbar Flexion.
Clinical Biomechanics, 19, 769-776.

Electrician's Job Demands

Overhead Work

Research Study




Understanding the Physical Demands
of an Electrician's Job

Electrician's Job Demands

Overhead Work

An electrician's job is physical in nature, and the physical demands of the job are affected by postures employed and environmental factors. Overhead work, or work at or above shoulder level, is an essential component of electrical work and is a risk factor for developing a shoulder injury. In the United States, shoulder injuries are third most reported cases behind low back and leg injuries (Nussbaum et al., 2001).

During the month of April in 2005, the International Brotherhood of Electrical Workers (IBEW) local 353 commissioned the Toronto Clinic of the Occupational Health Clinics for Ontario Workers (OHCOW) to complete a musculoskeletal discomfort/symptom survey of its membership. OHCOW found that in the last year (at the time of survey), an average of 50.35% of reporting union members experienced work related aches, pain, discomfort or numbness of the shoulder. Of the reporting members, 31.4% had sought a health care professional's advice for shoulder pain. Identifying potential mechanisms of injury within the job tasks of electrical work may prevent or lead to the reduction of work related injuries. OHCOW's findings appear to be in line with Hanna et al.'s (2005) findings about the factors affecting absenteeism in electrical construction; 52% [of Electrician's] reported they had a work-related injury sometime during their career that caused them to miss work.

Mechanisms of Injury

There are three main injury mechanisms (McGill, 2002). Most individuals can identify the "specific incident" injury mechanism where a load greater than the individual's tissue tolerance is applied, resulting in an injury (Appendix). An injury may also occur from the continuous application of a load resulting in an injury from the reduction in an individual's tissue tolerance over time. The final injury mechanism involves repeated loading, which decreases an individual's tissue tolerance over time until an injury finally occurs (McGill, 2002).

Potential Injuries

■ Musculoskeletal Disorders of the Shoulder:

The National Institute of Occupational Health and Safety (NIOSH) (1997) defines musculoskeletal disorders (MSDs) as a condition that involves the nerves, tendons, muscles, and supporting structures of the body. An MSD may cause pain, inflammation, reduced mobility as well as other symptoms. NIOSH (1997) states that repeated or sustained shoulder flexion and abduction greater than 60 degrees from neautral is positively associated with shoulder MSDs and shoulder tendonitis. When the shoulder nears its end range of motion in overhead work settings, stretching and compression of tendons and nerves occurs limiting blood flow to the joint and damaging tissues. The longer a fixed or awkward body position is held, the greater the risk of developing MSDs (CCOHS, 2002).

■ Shoulder Impingement, Shoulder Tendonitis & Rotator Cuff Injuries:

The rotator cuff is responsible for the internal and external rotation of the shoulder, but the prime function is to hold the head of the humerus in the shoulder socket during movement, increasing joint stability. The rotator cuff

is composed of four muscles: subscapularis, supraspinatus, infraspinatus and teres minor (Moore & Dalley, 1999). Shoulder impingement occurs when pressure is placed on the rotator cuff from the shoulder blade as the arm is lifted, which limits joint range of motion (AAOS, 2002).

Pain from a shoulder impingement may be due to an inflamed shoulder bursa or inflammation of the rotator cuff tendons. Shoulder impingement can become a chronic condition and may eventually lead to a torn rotator cuff. The American Academy of Orthopedic Surgeons (AAOS) (2002) lists repetitive lifting and overhead work as the main risk factors for incurring a shoulder impingement.

Shoulder tendonitis is the inflammation of the tendons of the shoulder. Hagberg et al. (1995) wrote that shoulder elevation and external forces acting on the shoulder impair circulation to the rotator cuff causing the tendons to degenerate and inflame. Circulation in the tendons also decreases as greater force is applied to the shoulder joint. Chaffin et al. (1999) confirmed that repeated elevation and sustained elevated shoulder postures can lead to degenerative tendonitis in the shoulder.

Risk Factors for Injuries

Shoulder injuries limit a worker's ability to perform daily work activities. Four main risk factors associated with the development of shoulder injuries are static loads, insufficient rest, vibration and lack of non-neutral postures (Nussbaum et al., 2001; Schell, 2000).

Shoulder Composition:

The shoulder joint is the most complicated joint in the body (Kumar, 1999). The head of the humerus sits in a cup formed by the shoulder blade (scapula), collar bone (clavicle) and associated ligaments and muscles (Moore & Dalley, 1999). The cup that the head of the humerus sits in is shallow, giving the joint high mobility but decreased joint stability. Therefore the shoulder joint is highly susceptible to injury (Chaffin et al., 1999). The shoulder, being a ball and socket joint, is capable of moving in three axes and accomplishes these movements using a number of muscles, the best known being the rotator cuff and the deltoids. The rotator cuff, as described above, is responsible for shoulder stability and is composed of the subscapularis, supraspinatus, infraspinatus and teres minor (Moore & Dalley, 1999). The shoulder joint is also surrounded by a capsule filled with fluid called the synovial membrane which lubricates and protects the joint.

Repeated use of the shoulder joint over time wears down the cartilage in the joint. Repetitive motion also warms the fluid in the joint capsule, making the fluid less viscous affecting its ability to lubricate the joint and protect it from compression forces.

Physical Demands Descriptions (PDDs) for IBEW local 353 were completed during the summer months of 2006. The PDDs revealed that reaching above the shoulder is a required posture that is frequently performed for 25-50% of a task. When working in an overhead position, the muscles involved in shoulder movement are working from an anatomically disadvantageous position affecting the muscles ability to protect the shoulder joint from applied forces (Chengalur et al., 2004). The Canadian Centre for Occupational Health and Safety (CCOHS) (2002) considers work involving shoulder elevation stressful for the shoulder to maintain. The higher a worker has to reach to complete a task, the shorter it takes for the worker to experience pain or fatigue. This is further complicated as a worker ages as endurance limits decrease (Chaffin et al., 1999)

Work posture and the external forces acting on the body are the most important factors in determining the force the shoulder musculature and ligaments must produce to support an external load (Kumar, 1999). The further the work performed by the shoulder is from a neutral position, the greater the forces produced by the shoulder are in order to achieve the given task (Chengalur et al., 2004).

When an arm is raised and unsupported, as in overhead electrical work, gravity pushes down on the extended arm, increasing the shoulder load. The musculature then activates to hold the arm in position. Flexion or abduction of the shoulder above 90 degrees is especially problematic, as stresses on the shoulder tendons, ligaments and other tissues increases greatly (Chaffin et al., 1999). Increasing forces on the shoulder cause increased joint compression, reduced circulation and increased muscular discomfort. As such, the higher a worker must raise their arm and the farther a worker must reach, the lower the weight that can be handled, effecting a worker's ability to handle tools and materials during overhead work (Chengalur et al., 2004).

Kumar (1999) found that forces on the hand and exerted by the hand increase muscle activation in the deltoids, but even more so in the rotator cuff muscles, placing them at risk for injury. When the arm is held in an elevated posture, Chaffin et al. (1999) noted that the shoulder musculature and upper fibres of the trapezius muscle were the first muscles to fatigue. This places the shoulder and cervical spine at risk for injury as the muscles ability to withstand forces is diminished.

It is also important to note that the greater the force required to sustain a posture, the quicker an individual will become fatigued (Hagberg et al., 1995). Therefore, as repetitions of shoulder flexion and extension increase, an individual may become more fatigued increasing the risk of a shoulder injury. Hagberg et al. (1995) also noted that the longer a static posture is held, the greater the need for recovery time between work activities or work shifts.

Nussbaum (2003) commented that localized musculoskeletal stresses can have consequences for the whole body. Although overhead work has a direct and easily identifiable connection with the shoulder and subsequent injuries to the shoulder, overhead work also increases lumbar spine extension and perceived exertion more so than work at chest height (Burton et al, 1994). Nussbaum (2003) also noted that overhead work decreases postural control and increases postural sway. Therefore overhead work also increases a worker's risk of developing a spinal injury due to a lowered ability to stabilize and protect one's spine from compression and shear forces.

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)

Supervised by: Syed Naqvi – PhD CCPE CPE (Ergonomist, OHCOW Inc.), David Mijatovic – BSc MHSc (Ergonomist, OHCOW Inc.) & Gary Majesky (IBEW L.U. 353)

Appendix

Injury Mechanisms (McGill, 2002)

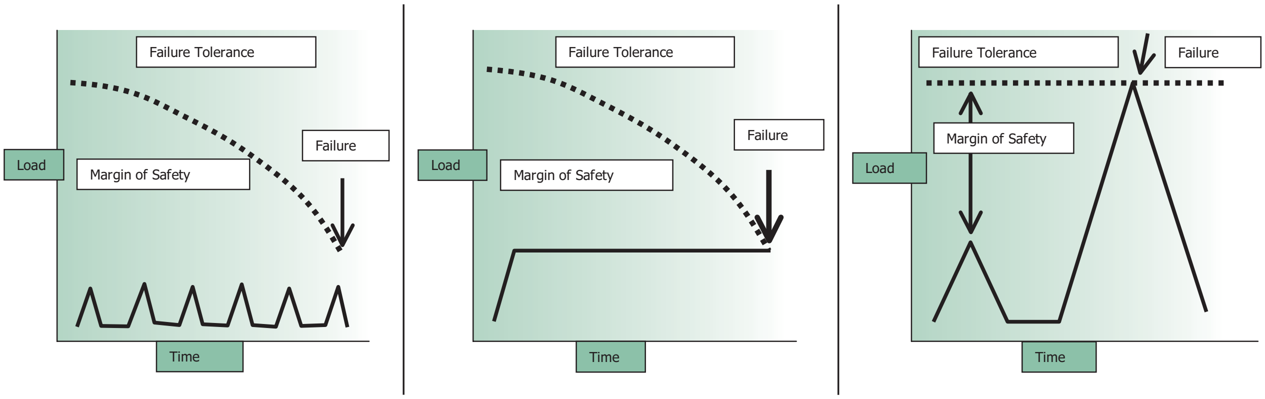


Table 1. Evidence for causal relationship between physical work factors and MSDs

Body part *Risk factor*	**Strong evidence (+++)**	**Evidence (++)**	**Insufficient evidence (+/0)**	**Evidence of no effect (-)**
Neck and Neck/shoulder				
Repetition		✓		
Force		✓		
Posture	✓			
Vibration			✓	
Shoulder				
Posture		✓		
Force			✓	
Repetition		✓		
Vibration			✓	

Source: NIOSH, 1997

Table 2 (Chengalur et al., 2004)
Primary Job Risk Factors Considered in Major Reviews

Risk Factor	Low Back	Distal Upper Extremities	Neck and Shoulders
Force	Strong	Strong	Strong
Awkward Posture	Strong	Strong	Strong
Static Posture	Good	Good	Good
Repetition	Good	Strong	Strong
Dynamic Factors	Good	Weak	Weak
Compression	Good	Weak	Weak
Vibration	Strong	Strong	Weak
Combined	Good	Strong	Good

Strong = strongly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders
Good = strongly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders
Weak = weakly correlated risk factor for MSDs in the low back/distal upper extremities/neck & shoulders

References

American Academy of Orthopedic Surgeons (2005, March).
Shoulder Impingement. Retrieved August 2, 2006 from
http://orthoinfo.aaos.org/fact/thr_report.cfm?thread_id=133&topcategory=shoulder

Burton, A., Tillotson, K. & Boocock, M. (1994). Estimation of Spinal Loads in Overhead Work.
Ergonomics, 37, 1311-1321.

Canadian Center for Occupational Health and Safety (2005, December 12).
Work Related Musculoskeletal Disorders. Retrieved August 1, 2006, from
http://www.ccohs.ca/oshanswers/diseases/rmirsi.html

Chaffin, D., Andersson, G. & Martin, B. (1999).
Occupational Biomechanics. New York: John Wiley & Sons, Inc.

Chengalur, S.N., Rodgers, S. & Bernard, T. (2004).
Kodak's Ergonomic Design for People at Work. New York: John Wiley & Sons, Inc.

Hagberg, M., Silverstein, B., Wells, R., Smith, M., Hendrick, H., Carayon, P. & Perusse, M. (1995).
Work Related Musculoskeletal Disorders (WMSDs): A Reference Book for Prevention. Great Britain: Taylor & Francis.

Hanna, A. S., Menches, C.L., Sullivan, K.T. & Sargent, J. (2005). Factors affecting absenteeism in electrical construction.
Journal of Construction Engineering and Management, 131, 1212-1218.

Kumar, S. (2001).
Biomechanics in Ergonomics. Philadelphia: Taylor & Francis Ltd.

McGill, S. (2002).
Low Back Disorders: Evidence-Based Prevention and Rehabilitation. Ontario: Human Kinetics.

Moore, K., & Dalley, A. (1999).
Clinically Orientated Anatomy. Baltimore: Lippincott, Williams & Wilkins.

Musculoskeletal Disorders and Workplace Factors:
A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back, U.S. Department of Health and Human Services, 2nd printing. (1997).

Nussbaum, M. (2003). Postural Stability is Compromised by Fatiguing Overhead Work.
AIHA Journal, 64, 56-61.

Nussbaum, M., Clark, L., Lanza, M. & Rice, K. (2001). Fatigue and Endurance Limits During Intermittent Overhead Work.
AIHA Journal, 62, 446-456.

Occupational Health Clinics for Ontario Workers (2006).
Discomfort Survey Results. Retrieved August 3, 2006 from
http://www.ibew353.org/survey%20results.pdf

Sakakibara, H., Miyao, M., Kondo, T. & Yamada, S. (1995). Overhead Work and Shoulder-Neck Pain in Orchard Farmers Harvesting Pears and Apples.
Ergonomics, 38, 700-706.

Schell, T. (2000).
Shoulder Osteoarthritis Literature Review. Toronto: Occupational Health Clinics for Ontario Workers.

Stenlund, B., Lindbeck, L. & Karlsson, D. (2002). Significance of House Painters' Work Techniques on Shoulder Muscle Strain During Overhead Work.
Ergonomics, 45, 455-468.

Electrician's Job Demands

Kneeling & Crouching

Research Study




Electrician's Job Demands

Kneeling & Crouching

The requirement to kneel and crouch is a major component of electrical work. These postures are assumed approximately 50% of the working electrician's time during certain activities. With increased use, comes the potential for injury. According to Hanna et al. (2005) in a research article about the factors affecting absenteeism in electrical construction, 52% [of Electrician's] reported they had a work-related injury sometime during their career that caused them to miss work.

During the month of April in 2005, the International Brotherhood of Electrical Workers (IBEW) local 353 commissioned the Toronto Clinic of the Occupational Health Clinics for Ontario Workers (OHCOW) to complete a musculoskeletal discomfort/symptom survey of its membership. OHCOW found that in the last year (at the time of survey), 67.6% of reporting union members experienced work related aches, pain, discomfort or numbness of the knees. Of the reporting members, 35.2% had sought a health care professional's advice for knee pain.

The knee experiences the most force during kneeling and crouching. As the knee is a weight bearing joint with high joint mobility it is susceptible to injury (Moore & Dalley, 1999). The knee, therefore, relies on ligaments and surrounding musculature to maintain its strength. Identifying potential mechanisms of injury within the job tasks of electrical work may lead to the reduction of work related injuries.

Mechanisms of Injury

There are three main mechanisms of injury (McGill, 2002). Most individuals can identify the "specific incident" injury mechanism where a load greater than the individual's tissue tolerance is applied, resulting in an injury (Appendix). An injury may also occur from continuous load application resulting in an injury from the reduction in an individual's tissue tolerance over time. The final injury mechanism involves repeated loading, which decreases an individual's tissue tolerance over time until an injury finally occurs (McGill, 2002).

Potential Injuries

Due to the mobility of the knee joint, it is susceptible to a number of injuries, especially patellofemoral syndrome, bursitis, and meniscal wear and tear.

Patellofemoral syndrome:

Under normal circumstances the patella (knee cap) moves along a groove in the femur. Disruption of the patella's normal tracking pattern from a direct blow or from the wearing down of articular cartilage in the knee results in the patella sliding around, further damaging bone and cartilage (Moore & Dalley, 1999). Since crouching, climbing and kneeling are a required element of electrical work, and comprise a significant portion of their working time, an electrician's risk of developing patellofemoral syndrome is increased.

Bursitis:

Bursitis in the knee is the inflammation of the bursa atop the patella. A bursa is a fluid-filled sac that reduces friction between body tissues (Medicinenet.com, 2003). The patellar bursa normally reduces friction that results from knee flexion and extension. Chronic compressive forces, such as continuous kneeling, or a direct blow to the patella can injure the bursa, causing it to swell and impede motion of the knee (Moore & Dalley, 1999; NIOSH, 1997). Compressive forces (contact stress) to the knee are further exacerbated when kneepads are not worn.

Meniscal Injuries:

The knee joint has lateral and medial menisci, which act as shock absorbers of the knee (Moore & Dalley, 1999). Repetitive motion and high levels of force can wear away the menisci, causing swelling and pain in the joint. The menisci also deepen the connection between the femur and tibia. When the menisci are worn down, knee joint instability can occur, increasing the risk of an injury occurring. As Electrician's employ kneeling and crouching on a daily basis, they are at increased risk of developing meniscal injuries.

Risk Factors for Injury

There are a number of factors that increase the risk of a knee injury. Dembe, et al. (2004) cited that a worker being exposed to six specific hazardous job activities – kneeling or crouching being one of the six, increases occupational injuries. A study by Bruchal in 1995 found that employees who work in a kneeling position experience more knee injuries than those that do not.

Kneeling and crouching also place high levels of force on the knee. High force, when combined with repetition of movement further increases the potential for a knee injury (NIOSH, 1997). Electrician’s work requires continuous flexion and extension of the knee, which can lead to degeneration of the tissues and ligaments making the worker susceptible to injury. Awkward body postures further increase the potential for a knee injury by altering the biomechanics that protect the knee from injury (Bhattacharya et al, 1985).

Lastly, high levels of contact stress on the knee from hard or uneven surfaces such as the floor, or ladder rungs is correlated with injuries such as bursitis, fluid build up in the knee and other knee complaints (NIOSH, 1990). Kneepads can be used to reduce the potential for a knee injury from contact stress.

It is also important to note that the greater the force required to sustain a posture, the shorter the time it takes for an individual to become fatigued (Hagberg et al., 1995). Therefore, as repetitions of knee flexion and extension increase, an individual may become more fatigued increasing the risk of a knee injury. Hagberg et al. (1995) also noted that the longer a static posture is held, the greater the need for recovery time between work activities or work shifts. It has also been noted that kneeling may reduce the ability to generate adequate hand forces, thus increasing the risk of injuries to the hand and forearm (Haslegrave et al., 1997).

The Spine

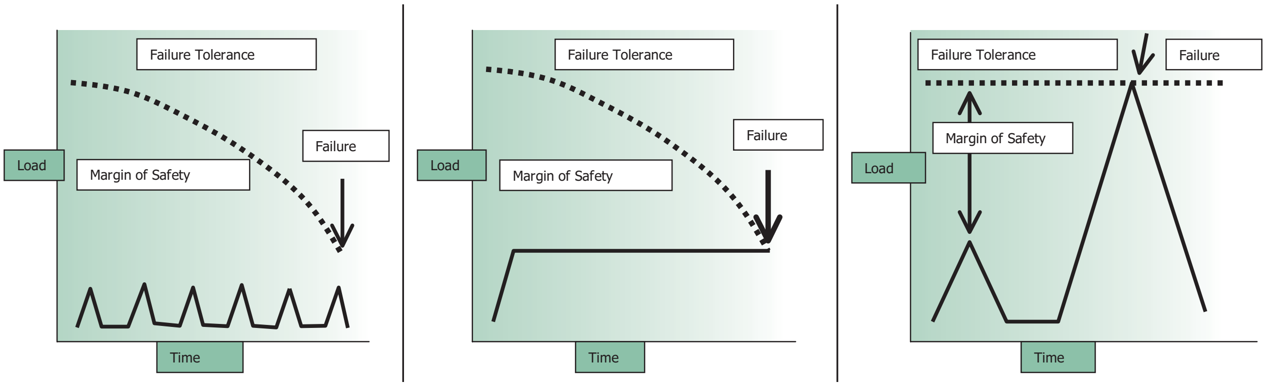
Although this paper has focused on the effects of kneeling and crouching on the knees, one must remember that the spine is also affected. Kneeling and crouching place the spine in a forward flexed position which decreases the ability of the spine to buttress itself from shear and compressive forces (McGill, 2002). As kneeling and crouching are frequently used working positions, the spine experiences cumulative repetitive force loading, increasing the risk of a spine injury (Marras, 2003).

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)

Supervised by: Syed Naqvi – PhD CCPE CPE (Ergonomist, OHCOW Inc.), David Mijatovic – BSc MHSc (Ergonomist, OHCOW Inc.) & Gary Majesky (IBEW L.U. 353)

Appendix

Injury Mechanisms (McGill, 2002)

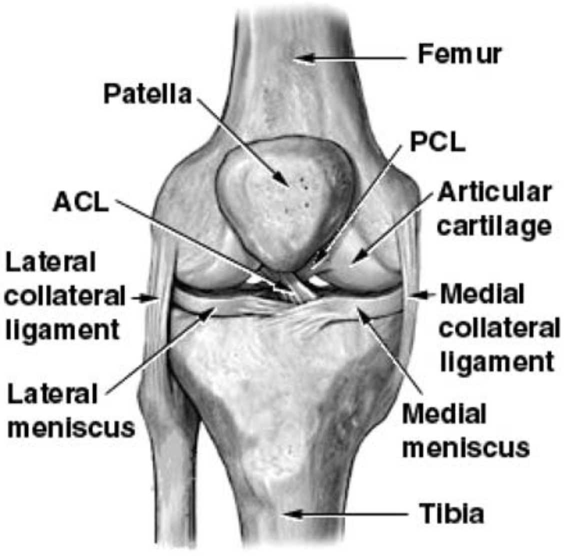


Tray 6-B. High Risk Repetition Rates by Different Body parts

From Kilbom Å [1994]. Repetitive work of the upper extremity; Part II: The scientific basis for the guide. Int J Ind Erg 14:59–86.

Body Part	Repetitions Per Minute
Shoulder	More than 2½
Upper Arm/Elbow	More than 10
Forearm/Wrist	More than 10
Finger	More than 200

Diagram of the Knee Joint (www.wbcarrellclinic.com)



Recovery Time Needs for Three Levels of Effort for Different Effort Durations
(Rodgers 1998)

Effort time plus recovery time is the time before repeating to avoid accumulating fatigue on a task.

Continuous Effort Time (seconds)	Recovery Time Needed for Nonfatiguing Work (seconds)		
	Heavy	Moderate	Light Effort
1	1	1	0
2	3	2	1
3	4	2	1
4	9	3	1
5	14	3	1
6	18	4	1
7	27	5	1
8	35	8	1
9	49	11	1
10	57	14	2
11	62	17	2
12	74	20	3
13	97	24	3
14	111	28	3
15	135	32	3
16	149	36	3
17	158	43	3
18	167	48	4
19	186	53	4
20	220	57	5
21		62	5
22		67	5
23		73	5
24		79	5
25		86	5
30			11
35			13
40			15
45			17
50			20
55			25
60			40

Source: Chengalur et al., 2004

References

American Academy of Orthopedic Surgeons (2005, March).
Shoulder Impingement. Retrieved August 2, 2006 from
http://orthoinfo.aaos.org/fact/thr_report.cfm?thread_id=133&topcategory=shoulder

Burton, A., Tillotson, K. & Boocock, M. (1994). Estimation of Spinal Loads in Overhead Work.
Ergonomics, 37, 1311-1321.

Canadian Center for Occupational Health and Safety (2005, December 12).
Work Related Musculoskeletal Disorders. Retrieved August 1, 2006, from
http://www.ccohs.ca/oshanswers/diseases/rmirsi.html

Chaffin, D., Andersson, G. & Martin, B. (1999).
Occupational Biomechanics. New York: John Wiley & Sons, Inc.

Chengalur, S.N., Rodgers, S. & Bernard, T. (2004).
Kodak's Ergonomic Design for People at Work. New York: John Wiley & Sons, Inc.

Hagberg, M., Silverstein, B., Wells, R., Smith, M., Hendrick, H., Carayon, P. & Perusse, M. (1995).
Work Related Musculoskeletal Disorders (WMSDs): A Reference Book for Prevention. Great Britain: Taylor & Francis.

Hanna, A. S., Menches, C.L., Sullivan, K.T. & Sargent, J. (2005). Factors affecting absenteeism in electrical construction.
Journal of Construction Engineering and Management, 131, 1212-1218.

Kumar, S. (2001).
Biomechanics in Ergonomics. Philadelphia: Taylor & Francis Ltd.

McGill, S. (2002).
Low Back Disorders: Evidence-Based Prevention and Rehabilitation. Ontario: Human Kinetics.

Moore, K., & Dalley, A. (1999).
Clinically Orientated Anatomy. Baltimore: Lippincott, Williams & Wilkins.

Musculoskeletal Disorders and Workplace Factors:
A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back, U.S. Department of Health and Human Services, 2nd printing. (1997).

Nussbaum, M. (2003). Postural Stability is Compromised by Fatiguing Overhead Work.
AIHA Journal, 64, 56-61.

Nussbaum, M., Clark, L., Lanza, M. & Rice, K. (2001). Fatigue and Endurance Limits During Intermittent Overhead Work.
AIHA Journal, 62, 446-456.

Occupational Health Clinics for Ontario Workers (2006).
Discomfort Survey Results. Retrieved August 3, 2006 from http://www.ibew353.org/survey%20results.pdf

Sakakibara, H., Miyao, M., Kondo, T. & Yamada, S. (1995). Overhead Work and Shoulder-Neck Pain in Orchard Farmers Harvesting Pears and Apples.
Ergonomics, 38, 700-706.

Schell, T. (2000).
Shoulder Osteoarthritis Literature Review. Toronto: Occupational Health Clinics for Ontario Workers.

Stenlund, B., Lindbeck, L. & Karlsson, D. (2002). Significance of House Painters' Work Techniques on Shoulder Muscle Strain During Overhead Work.
Ergonomics, 45, 455-468.

(Continued from page 8)

When looking at the job description of electrical work one can clearly relate certain job activities to specific muscle groups. Overhead work affects the neck, shoulders, arms, elbows, wrist/hands. Work that is straight over head, or working on ladders in an awkward off-plane position, places increased stress on the low back. And knee's and ankles if working on a ladder or lift where you need to stretch and twist in order to reach your work.

Confined work or low level work can put a lot of stress on your low back, hips, knee's, shoulders, elbows and neck.

Terminating panels or a lot of drilling and mounting equipment can have huge effects on your arms, elbows, wrists and hands.

As one can see, the job of electrician is very physical and each member reacts differently to the work factors, which is complicated by your genetic makeup, age, body type, general health, strength, flexibility, duration that certain work is performed, location of work and trade experience.

What we need to take away from this study is that we need to change how we work and our attitudes to how work is organized. Construction is a tough game. It can and will break down all the supermen we have in the trade, bar none, and it does affect every one of us.

Right now our bodies are being used as filters as we breath in all the pollution that all job sites offer. The members are also breaking down physically because of our current trade work practices and attitudes. It is our hope that we can use this study to educate members, foreman, contractors, other trades, and WSIB, that there are alternatives that can allow all of us to enjoy a healthier future.

The problems we have cannot be blamed on any one sector, nor can we realistically eliminate all the disagreeable aspects of our work and the associated risks factors to injury and disease. But we can take small steps that are common sense to improve our collective health and safety by continued education, use of Personal Protective Equipment (PPE), change of job practices, rotation of work, and increased house keeping. Some of these are taught and advocated, but in reality, there is either intentional defiance by some workers and contractors, or just lip service paid to these programs.

At the end of the day, we all have to start thinking about the common sense strategies so we work smarter and safer to protect your health and safety.

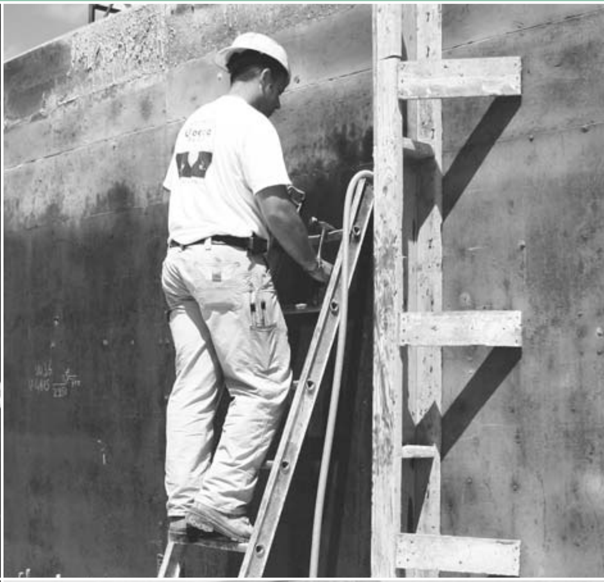
By the summer of 2006 we will have completed our ergonomic review and physical demands analysis, in conjunction with Western University and OHCOW, of our five trade sectors (Industrial Commercial Institutional, Line & Utility, High-rise Residential, Low-rise Residential and the Communication).

Joe Fashion, Business Manager Barry Stevens, President

Electrician's Job Demands

Ladder Work

Research Study



Understanding the Physical Demands of an Electrician's Job

Electrician's Job Demands

Ladder Work

An electrician's job requires daily use of climbing devices such as ladders. Ladders are employed in all five sectors of electrical work. With increased use, comes the potential for injury. Chengalur et al. (2004) reported that falls from ladders are one of the leading causes of injury and death in the United States. Ergonomic and biomechanical factors are a contributing factor in worker falls, therefore identifying correct biomechanical parameters of ladder construction and use could potentially reduce worker injuries and falls (Kumar, 2001). Safety training can also assist in reducing the number of injuries and falls associated with ladders (NIOSH, 2004).

Potential Injuries & Biomechanics of Ladder Use

(Only male subjects were analyzed)

Slips and Falls:

Slips and falls are a major cause of work related injuries. In 1999, the Canadian Centre for Occupational Health and Safety (CCOHS) reported that approximately 40% of all falls occur from a height. CCOHS (2005) research attributes a majority of slips and falls to a loss of balance as a result of an "unexpected change in the contact between the feet and the ground." With elevated slips and falls, the resulting change in ground contact can refer to the ladder base and the floor. Therefore correct placement of a ladder on even ground, free of obstructions and debris and well-maintained, clean ladders reduce the potential for falls and subsequent injury (Christensen & Cooper, 2005). Workers must also use caution when ascending and descending a ladder as workers exert less ladder control when climbing quickly (Kumar, 2001).

Centre of Mass & Base of Support:

Center of mass, also referred to as centre of gravity, is defined as a point within the body at which an individual's mass seems to concentrate around (Wikipedia, 2006). Centre of mass is critical to the maintenance of balance. An individual will remain balanced as long as their centre of mass is within their base of support. When an individual is standing, their base of support is the area around their feet. The wider their feet are spaced apart, the larger their base of support and the greater their postural stability (University of Illinois, 1998).

In order to maintain postural stability, one's centre of mass must be within their base of support. Lehtola et al. (2004) reported a frequent cause of ladder related injuries is from reaching too far to the left or right when working on a ladder. A majority of work on ladders is done with overhead obstructions resulting in workers being placed in awkward positions that can fall outside of their base of support. Tsipouras et al. (2001) also reported in their study of 163 documented fall patients, 43% of accidents occurred from ladder instability due to workers reaching beyond a ladder's edge to accomplish a task.

The University of Illinois (1998) also reported that vision is a factor in maintaining postural support. CCOHS (2005) recommends lighting levels to be a minimum of 50 lux to prevent falls and slips.

The following describes the effect of ladder use on various body segments:

Hands

(Kumar, 2001 & Bloswick and Chaffin, 1990)

The hands are used primarily to balance the body when ascending or descending a ladder. The total peak two-handed force was approximately 25% of a climber’s body weight. The force on the hands increases as the ladder slant is raised from 70 to 90 degrees and as the rung separation becomes greater. A potential risk of hand slip is possible as the maximum one-hand force increases to 35% of maximum grip strength if ladder rungs are slippery or wet.

Elbow & Shoulder

(Kumar, 2001 & Bloswick and Chaffin, 1990)

During vertical ladder use the peak elbow flexion moment was 45% of its maximum producible static moment while that peak shoulder extension moment was 15% of its maximum producible static moment. The average shoulder moment was 5% of static maximum. All measured forces were of very short duration and carry a low risk of injury.

Hip & Knee

(Kumar, 2001 & Bloswick and Chaffin, 1990)

Maximum hip flexion was measured at 55 degrees and maximum knee flexion was 70 degrees during ladder use.

Feet

(Kumar, 2001 & Bloswick and Chaffin, 1990)

The average force on one foot while ascending and descending a ladder ranged from 48-64% of a climber’s body weight with a maximum force of 85% and varies according to the slant of the ladder. Foot slip potential is highest during vertical ladder use, as the coefficient of friction is lowest (0.4).

Spine

(Kumar, 2001; Bloswick and Chaffin, 1990; Rodgers et al., 1986)

When climbing ladders, measured estimates of shear, compression and total forces on the low back (L5/S1) were below the NIOSH action limit of 3400 N and the NIOSH maximum permissible limit of 6400 N in Bloswick & Chaffin’s 1990 research. Erector spinae activity was measured to be approximately 65% of static maximum force production and increased as the slant of the ladder was raised from 70 to 90 degrees. Peak erector spinae IEMG measurements approached 100% of static maximum force production as climbing speed increased during the use of vertical ladders, which indicates a potential for injury to the low back.

Ladder Design & Recommended Ladder Parameters

(Please see Appendix for figures)

This review refers to two types of rigid, portable ladders: extension ladders and step ladders. Electrician's usually employ ladders in 4 – 12 foot lengths, although longer ladders may be used for certain jobs and are made of metal, fibreglass, or wood. Ladder steps are called rungs. Rigid ladders are usually portable, but some may be fixed to buildings.

Parameter	Recommendation	Source
Slope of ladder use	70+ degrees (70 degrees is optimal)	Chengalur et al. (2004); NIOSH (1997); Kumar (2001)
Rung separation	10 – 12 inches (> 14 in. is 'fatiguing')	Chengalur et al. (2004); NIOSH (1997); Kumar (2001)
Rung diameter	0.75 – 1.5 inches (1.125 inches – wood)	NIOSH (1997); Kumar (2001)
Rung width	15 – 24 inches	Chengalur et al. (2004); NIOSH (1997), Kumar (2001)
Rung type	Flat on top & able to accept the midpoint of the foot	NIOSH (1997)
Toe depth	3+ inches	Chengalur et al. (2004)
Ladder clearance	30 – 36 inches	NIOSH (1997)
Ladder material	Wood or metal	Kumar (2001)
Other	Tie off when 3+ meters off the ground to prevent fall injuries	CCOHS (2005)

Further Recommendations on Ladder Use

NIOSH (1997) also states that the first step off the ground to the bottom rung of the ladder must be reachable by the shortest person working on site. Two handholds must also be reachable from the ground allowing for all workers to begin their ascension with three points of contact to the ladder. Three points of contact are recommended while ascending or descending a ladder, however Kumar et al. (2001) reported extended periods in a worker's gait pattern when only two points of contact occur. Bloswick & Chaffin (1990), referenced in Kumar (2001), reported a decrease in workers' control of a ladder when ascending and descending during fast climbing. Therefore workers should maintain a steady, slower pace when ascending or descending a ladder.

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)

Supervised by: Syed Naqvi – PhD CCPE CPE (Ergonomist, OHCOW Inc.), David Mijatovic – BSc MHSc (Ergonomist, OHCOW Inc.) & Gary Majesky (IBEW L.U. 353)

Appendix

Table: Static Work Duration as a Function of Intensity
(Rodgers et al., 1986)

Percent of Maximum Static Strength	Maximum Endurance Time
100	6 seconds
75	21 seconds
50	1 minute
25	3.4 minutes
15	>4 minutes

Figure: Vertical Ladder Design
(NIOSH, 1997)

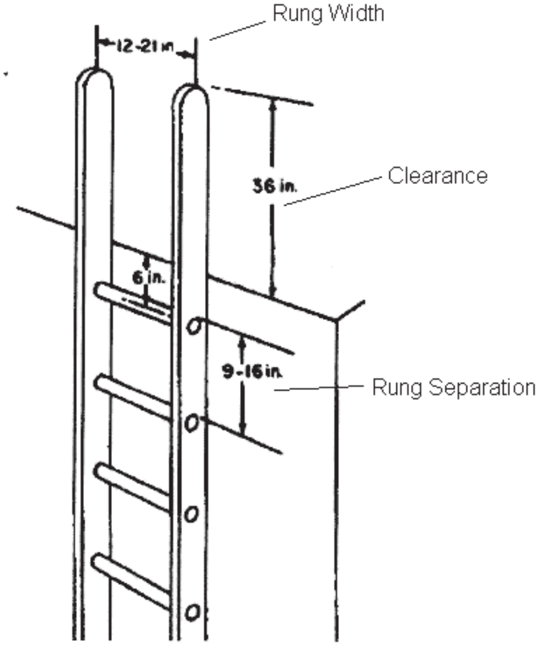
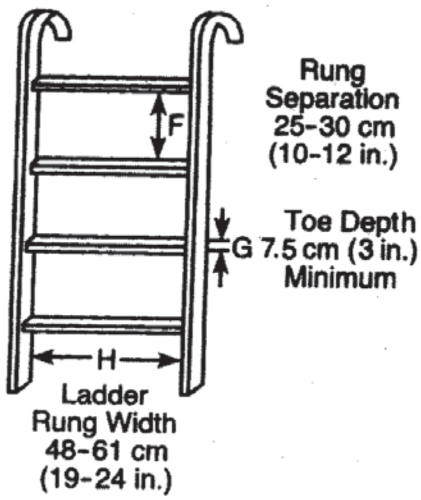


Figure 6 - Vertical ladder design. (2)

Figure: Design of Ladder
(Chengalur et al., 2001)



References

Bloswick, D. & Chaffin, D. (1990). An Ergonomic Analysis of the Ladder Climbing Activity. *International Journal of Industrial Ergonomics*, 6, 17-27.

Canadian Center for Occupational Health and Safety (2005, May 25). *Ladder Ergonomics*. Retrieved July 5, 2006, from http://www.ccohs.ca/oshanswers/ergonomics/ladders.html

Canadian Centre for Occupational Health and Safety (2005, June 16). *Why Do We Need to Worry So Much About Falls on Stairs?* Retrieved July 7, 2006 from http://www.ccohs.ca/oshanswers/safety_haz/stairs_fallprevention.html

Canadian Centre for Occupational Health and Safety (1999, June 10). *Why is the Prevention of Slips, Trips and Falls Important?* Retrieved July 7, 2006 from http://www.ccohs.ca/oshanswers/safety_haz/falls.html

Chengalur, S.N., Rodgers, S. & Bernard, T. (2004). *Kodak's Ergonomic Design for People at Work*. New York: John Wiley & Sons, Inc.

Christensen, T. & Cooper, N. [Occupational Hazards Safety Zone] (2005, November 21). *Attacking Ladder Falls One Rung at a Time*. Retrieved July 7, 2006 from http://www.occupationalhazards.com/safety_zones/37/article.php?id=14333

Hanna, A. S., Menches, C.L., Sullivan, K.T. & Sargent, J. (2005). Factors affecting absenteeism in electrical construction. *Journal of Construction Engineering and Management*, 131, 1212-1218.

Kumar, S. (2001). *Biomechanics in Ergonomics*. Philadelphia: Taylor & Francis Ltd.

Lehtola, C., Becker, W. & Brown, C. [National AG Safety Database – University of Florida] (2004, July). *Preventing Injuries from Slips, Trips and Falls*. Retrieved July 7, 2006 from http://www.cdc.gov/nasd/docs/d000001-000100/d000006/d000006.html

McGill, S. (2002). *Low Back Disorders: Evidence-Based Prevention and Rehabilitation*. Ontario: Human Kinetics.

National Institution for Occupational Safety and Health (1997). *Design Recommendations for Catwalks, Ladders and Stairs*. Retrieved July 5, 2006 from http://www.cdc.gov/niosh/pot_wlk2.html

National Institution for Occupational Safety and Health (2004). *Portable Ladders for Construction Self-Inspection Checklist*. Retrieved July 5, 2006 from http://www.cdc.gov/niosh/docs/2004-101/chklists/r1n731~1.htm

Occupational Health Clinics for Ontario Workers (2006). *Discomfort Survey Results*. Retrieved August 3, 2006 from http://www.ibew353.org/survey%20results.pdf

Rodgers, S., Kenworthy, D., Eggleton, E., Kiser, D., Murphy, T. & Nielson, W. (1986). *Ergonomic Design for People at Work*. New York: Van Nostrand Reinhold.

Tsipouras, S., Hendrie, J. & Silvapulle, M. (2001). Ladders: Accidents Waiting to Happen. *Medical Journal of Australia*, 174, 516-519.

University of Illinois.(1998). *Postural Control*. Retrieved on July 10, 2006 from http://www.kines.uiuc.edu/kines-courses/kines-257/Laboratory_files/257Lab4.html

Wikipedia. (2006, July 10). *Centre of Mass*. Retrieved on July 10, 2006 from http://en.wikipedia.org/wiki /Center_of_gravity

ICI – Construction & Maintenance

Date June 20, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

IBEW Sector Industrial Commercial Institutional | **Job Title** Electrician | **Type of Work** – Construction & Main.

PHYSICAL DEMANDS			Not Component	*FREQUENCY: Seldom	Minor	Required	Major	LOAD (object/tool): Maximum (Kg)	Usual (Kg)	COMMENTS
STRENGTH	Lifting					x		38	5	Lifting materials off the ground
	Carrying					x		38	5	Carrying conduit from threader to installation point; wearing a tool belt
	Pushing			x						Pushing wire into conduit
	Pulling					x				Wire pulling through conduit
	Handling						x	38	4	Materials & tools handling; Maximum lift – bundle of 1" conduit (38 Kg)
	Throwing		x							
	Gripping	Power Grasp					x			Wire pulling, conduit installation
		Pinch Grasp			x					Inserting wires into breaker panel
	Reaching	Above Shoulder				x				Wire pulling, conduit installation, overhead work
		Below Shoulder		x						
		To the Side			x					Awkward conduit installation
POSTURES	Shoulder	Abduction			x					Conduit installation, reaming conduit
		Flexion					x			Overhead work, wire pulling
	Hip	Abduction			x					Balancing in awkward positions
	Wrist	Flexion/Extension			x					
		Radial/Ulnar Devn			x					
		Pronate/Supinate				x				Installing conduit
	Trunk	Flexion					x			Conduit installation, working in small spaces
		Extension			x					Overhead work; ladder work
		Side Bend			x					Overhead work; ladder work
		Twist			x					Overhead work; ladder work
	Neck	Flexion				x				Threading conduit, conduit installation
		Extension				x				Overhead work, wire pulling
		Side Bend		x						
		Twist		x						
MOBILITY	Sitting		x							Work is performed standing, crouching or kneeling
	Standing						x			
	Walking						x			
	Climbing				x					Stairs & ladders
	Crawling			x						
	Crouching					x				Installation of conduit
	Kneeling					x				Installation of conduit
	Balancing				x					Stairs, ladders, working above previously installed pipes
	Foot Action	One Foot			x					Kneeling
		Feet					x			
	Fine Finger Movements				x					Selection and insertion of wires into panels

*FREQUENCY

SELDOM = Not always performed during completion of job

MINOR = Performed less than 25% of job

REQUIRED = Frequent Repetition for 25%-50% of job

MAJOR = Frequent Repetition for more than 50% of job

ICI – Construction & Maintenance

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations			x			During initial site organization, communicating during wire pulling, etc.
		Other Sounds		x				Emergency alarms
	Vision	Far				x		Past 5 feet; seeing potential obstacles during conduit layout
		Near				x		Installation of conduit, conduit threading & bending
		Colour				x		Selecting correct wire based on colour
		Depth				x		Determining the layout of conduit based on obstacles from pre-existing piping
	Perception	Spatial – organization				x		Layout of conduit
		Form - recognition				x		Distinguishing different sizes of conduit, selecting the correct screws
	Feeling						x	
	Reading				x			Reading site layout
	Writing			x				
	Keying/Typing		x					
	Speech				x			Communicating during wire pulling, etc.
WORK ENVIRONMENT	Outside Work					x		
	Hot			x				Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather.
	Cold			x				Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Outdoor slab work stops during heavy rain; work mostly in dry weather/environments
	Dust			x				
	Vapour Fumes			x				Sewage treatment plant
	Noise						x	Construction equipment, treatment plant noise
	Vibration	Whole Body	x					
		Upper Extremity				x		Drills, conduit threader
	Contact Stress					x		Drills, conduit threader, Chicago bender
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (eg. Hammer)
	Moving Objects			x				Workers moving materials
	Hazardous Machines			x				
	Electrical						x	
	Sharp Tools				x			Conduit threader, conduit reamer
	Radiant/Thermal Energy		x					
	Slippery			x				Outdoor surfaces can become slippery when it rains
	Congested Worksite						x	Previously laid piping & conduit
	Chemical Irritants		x					
CONDITIONS	Works Independent but in Group						x	Work is primarily done in groups of 2
	Operate Equipment/Machinery					x		Drills, Chicago bender, etc.
	Machine Paced				x			Speed of conduit bender, threader
	Production Quotas						x	Work must be done in a specific timeframe
	Deadline Pressures				x			Fairly quick, continuous work rate
	Irregular/Extended Hours			x				

*FREQUENCY
SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

ICI – Conduit & Unistrut

Date August 22, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

IBEW Sector – Industrial Commercial Institutional | **Job Title** Electrician | **Type of Work** – Conduit & Unistrut

PHYSICAL DEMANDS			Not Component	*FREQUENCY				LOAD (object/tool)		COMMENTS
				Seldom	Minor	Required	Major	Maximum (Kg)	Usual (Kg)	
STRENGTH	Lifting					x			5	Materials handling of unistrut, conduit
	Carrying				x				5	Carrying unistrut, electric hand saw, tool belt
	Pushing				x					Pushing unistrut or conduit into place
	Pulling				x					Pulling unistrut or conduit into place
	Handling						x		5	Materials & tools handling
	Throwing			x				>1	>1	Tossing a fixture to a worker on the elevated lift (approx. 8' from ground)
	Gripping	Power Grasp			x					Using electric hand saw, bending conduit
		Pinch Grasp			x					Picking up connectors & clamps
	Reaching	Above Shoulder					x			Installing unistrut and conduit
		Below Shoulder			x					Picking materials up off the floor of the lift
		To the Side				x				Installing unistrut
POSTURES	Shoulder	Abduction				x				Overhead work in an awkward position
		Flexion					x			Overhead work
	Hip	Abduction	x							
	Wrist	Flexion/Extension		x						
		Radial/Ulnar Devn			x					Bolting fixture to unistrut
		Pronate/Supinate			x					Bolting fixture to unistrut
	Trunk	Flexion				x				Ducking under preexisting framing on ceiling
		Extension			x					Overhead work in an awkward position
		Side Bend			x					Overhead work in an awkward position
		Twist			x					Overhead work in an awkward position
	Neck	Flexion		x						Reading blueprints, driving elevated lift platform
		Extension					x			Overhead work
		Side Bend		x						Overhead work in an awkward position
		Twist			x					Overhead work in an awkward position
MOBILITY	Sitting		x							
	Standing						x			
	Walking				x					Walking on elevated lift platform, gathering materials
	Climbing				x					Climbing on to elevated lift platform
	Crawling		x							
	Crouching			x						Cutting unistrut
	Kneeling			x						
	Balancing				x					Balancing on moving elevated lift platform
	Foot Action	One Foot		x						Climbing ladder into elevated lift platform
		Feet					x			Standing on elevated lift platform
	Fine Finger Movements				x					Inserting clamps into unistrut, bolting fixture to unistrut

***FREQUENCY**

SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

ICI – Conduit & Unistrut

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations				x		Communicating with partner regarding task at hand
		Other Sounds		x				Potential emergency calls and alarms
	Vision	Far				x		Seeing past 5 feet; identifying a path for the lift to follow
		Near					x	Installing unistrut and conduit
		Colour		x				Reading blueprints
		Depth				x		Determining the amount of offset needed in the conduit
	Perception	Spatial – organization				x		Layout of conduit
		Form - recognition				x		Identifying different sizes of conduit; different connectors
	Feeling					x		Tightening bolts, inserting clamps into the unistrut
	Reading				x			Reading blueprints
	Writing				x			Marking out the layout
	Keying/Typing		x					
	Speech					x		Communicating with partner to complete layout
WORK ENVIRONMENT	Outside Work			x				Most work is completed under building cover
	Hot				x			Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather
	Cold				x			Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Work is completed in an unfinished building (no doors or windows)
	Dust						x	Construction site
	Vapour Fumes						x	Elevated lift platform generator
	Noise						x	Construction equipment, alarm from lift platform
	Vibration	Whole Body		x				Standing on the platform of the lift while its moving
		Upper Extremity		x				Using electric hand saw
	Contact Stress			x				Cutting unistrut with electric hand saw
	Striking with Hand/Fist		x					Striking is accomplished with hand tools
	Moving Objects						x	Elevated lift platform
	Hazardous Machines						x	Electric hand saw, elevated lift platform
	Electrical			x				Electric hand saw, elevated lift platform
	Sharp Tools			x				Electric hand saw
	Radiant/Thermal Energy		x					
	Slippery			x				Muddy terrain if it rains
	Congested Worksite					x		Machinery, building supplies, uneven terrain
	Chemical Irritants		x					
CONDITIONS	Works Independent but in Group						x	Work is completed individually once the layout is complete
	Operate Equipment/Machinery					x		Elevated lift platform, electric hand saw
	Machine Paced						x	Elevated lift platform
	Production Quotas					x		Must complete work in a certain cycle of time to remain on schedule
	Deadline Pressures						x	Must work to the contractor's predetermined schedule
	Irregular/Extended Hours			x				

*FREQUENCY
SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

Electrician's Job Demands

Conduit & Unistrut

Photographs

Understanding the Physical Demands of an Electrician's Job

Leaders Who SUPPORT Local 353 Intake Clinic

We have made great strides in health and safety in the construction sector over the years. Especially on the safety side. Where we have to move now is to start and look at the health issues. There are more people dying of disease and critical deaths. This Intake Clinic will bring to the forefront of peoples minds, from government and workers, the issue of occupational health and disease.

John Smith
LU 353 Exec-Board Member
Bus Rep Toronto Building Trades Council

We know that these clinics in every single community where we held them, have led and provided the spark to raise the issue of occupational health in that community. If you go to Sarnia today and talk to anybody on the street, they know about occupational disease, and they know somebody that has an occupational disease from the industries in that community.

Wayne Samuelson
President Ontario Federation of Labour

It's just amazing how many people are still exposed to asbestos. When you look at the stats last year, the WSIB recognized 37 mesothelioma claims, which is taught in the medical schools to be a rare disease. It is absolutely not a rare disease.

Dr. Noel Kerin
Occupational Health Physician (OHCOW)

You, your family and loved ones shouldn't have to suffer the burden of a fatal illness. Exposure to hazardous materials is no different than an employer allowing you to use a faulty ladder where you fall down and brake your neck or get killed. When dealing with an occupational disease, because of the latency period, this allows us to have a laissez faire attitude to the exposure of hazardous materials and associated illness.

The LU 353 Occupational Health Clinic is an important initiative and one I whole heartedly support. Joe Fashion and the leadership of your union have risen to the challenge by holding this clinic and are to be congratulated. As a IBEW member I'm deeply concerned about occupational health and how we as construction workers are affected. You have my commitment that I will act upon the findings generated and will support ongoing research through my role as a WSIB Board of Director and Business Manager of the Provincial Bldg Trades Council.

Patrick Dillon
Bus Mgr Provincial Bldg Trades Council
Board of Directors, WSIB

Brotherhood -
Working Together To Improve Your Health

ICI – Preventative Maintenance (Steam Plant)

Date June 30, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

IBEW Sector Industrial Commercial Institutional | **Job Title** Electrician | **Type of Work** – Preventative Maintenance

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	LOAD (object/tool) Maximum (Kg)	Usual (Kg)	COMMENTS
STRENGTH	Lifting				x			19	> 1	Lifting tool box off the floor; Usually lifting a small tool (ie. Screwdriver)
	Carrying				x			19	1	A tool belt is carried to the work area; Usually carrying a spool of wire
	Pushing						x	2.5	2.5	Pushing on screw head to tighten screw
	Pulling				x					Wire pulling over distance of approx. 2 – 2 ½ ft
	Handling				x			19	> 1	Handling a small screwdriver
	Throwing		x							
	Gripping	Power Grasp		x						Using pliers
		Pinch Grasp					x			Gripping of small screwdriver
	Reaching	Above Shoulder				x				Tightening screws in the top half of the control panel (Distance of 60"+ from the floor)
		Below Shoulder				x				Tightening screws in the bottom half of the control panel
		To the Side		x						
POSTURES	Shoulder	Abduction				x				
		Flexion					x			
	Hip	Abduction	x							
	Wrist	Flexion/Extension				x				
		Radial/Ulnar Devn		x						
		Pronate/Supinate			x			Screwing motion mostly emanates from fingers		
	Trunk	Flexion			x					
		Extension	x							
		Side Bend	x							
		Twist		x						
	Neck	Flexion			x					
		Extension		x						
		Side Bend	x							
		Twist	x							
MOBILITY	Sitting					x		Preventative maintenance (PM) from the floor to a height of 59" is completed in a seated position		
	Standing						x	Replacing high temperature wires; PM on control panel		
	Walking				x					
	Climbing				x			Climbing one flight of stairs		
	Crawling		x							
	Crouching		x							
	Kneeling		x							
	Balancing			x				Carrying items up one flight of stairs		
	Foot Action	One Foot	x							
		Feet				x		Standing, climbing stairs		
	Fine Finger Movements						x	Tightening of control panel screws, insertion of wire into connection		

***FREQUENCY**

SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

ICI – Preventative Maintenance

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations	x					
		Other Sounds		x				Emergency alarms
	Vision	Far	x					
		Near					x	Distances of 26” from the nose
		Colour			x			
		Depth			x			
	Perception	Spatial – organization			x			
		Form - recognition					x	Recognizing different breakers and screws
	Feeling						x	Determination of endpoint for screwing screws
	Reading		x					
	Writing		x					
	Keying/Typing		x					
	Speech			x				
WORK ENVIRONMENT	Outside Work		x					Inside work environment
	Hot			x				Upper floors can become hot in summer months
	Cold		x					Indoor work environment
	Humid		x					Indoor work environment
	Dry						x	The work environment is dry as it is inside
	Dust			x				Electrician dusts the components after servicing
	Vapour Fumes			x				
	Noise						x	Steam plant
	Vibration	Whole Body	x					
		Upper Extremity	x					
	Contact Stress				x			Screwing in screws, using pliers
	Striking with Hand/Fist		x					
	Moving Objects			x				
	Hazardous Machines		x					
	Electrical						x	Working on electrical components
	Sharp Tools			x				Pliers
	Radiant/Thermal Energy			x				Preventative maintenance is performed when the steam plant is up and running
	Slippery		x					
	Congested Worksite			x				
	Chemical Irritants		x					
CONDITIONS	Works Independent but in Group		x					Preventative maintenance is completed individually
	Operate Equipment/Machinery		x					
	Machine Paced		x					
	Production Quotas						x	Must complete work by a certain date
	Deadline Pressures			x				
	Irregular/Extended Hours			x				May do emergency calls

*FREQUENCY
SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

All Sectors – Ladder Worker

Date July 7, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

IBEW Sectors ICI, Residential, Line/Utility, Traffic, Communication | **Job Title** Electrician | **Type of Work** Ladders

PHYSICAL DEMANDS			Not Component	*FREQUENCY				LOAD (object/tool)		COMMENTS
				Seldom	Minor	Required	Major	Maximum (Kg)	Usual (Kg)	
STRENGTH	Lifting				x			20	5	Lifting a ladder, materials for the job
	Carrying						x	20	5	A tool belt is worn to carry tools – hammer, drill (Approx. 5 Kg); Carrying a ladder
	Pushing				x					Pushing the ladder into place
	Pulling				x					Pulling the ladder into place
	Handling				x			20	5	Moving the ladder, gathering supplies
	Throwing		x							
	Gripping	Power Grasp				x				Using a drill or hammer
		Pinch Grasp			x					Holding nails or small components
	Reaching	Above Shoulder					x			Overhead work
		Below Shoulder			x					Locating equipment on the ladder platform when doing overhead work
		To the Side			x					Overhead work is in an awkward location
POSTURES	Shoulder	Abduction				x				Overhead work is in an awkward location
		Flexion					x			Overhead work
	Hip	Abduction	x							
	Wrist	Flexion/Extension		x						
		Radial/Ulnar Devn			x					Holding ladder sides when ascending/descending the ladder, drilling
		Pronate/Supinate		x						
	Trunk	Flexion			x					Looking down when descending a ladder, locating equipment, etc. on the ladder platform when doing overhead work
		Extension					x			Overhead work
		Side Bend			x					Overhead work is in an awkward location
		Twist			x					Overhead work is in an awkward location
	Neck	Flexion			x					Looking down when descending a ladder, locating equipment, etc. on the ladder platform when doing overhead work
		Extension					x			Overhead work
		Side Bend			x					Overhead work is in an awkward location
		Twist			x					Overhead work is in an awkward location
MOBILITY	Sitting		x							
	Standing						x			
	Walking					x				Walking to different task sites, retrieving equipment
	Climbing					x				Ascending/descending a 12' ladder
	Crawling		x							
	Crouching		x							
	Kneeling			x						Knees may rest on ladder rungs while working
	Balancing						x			Balancing while working/ascending/descending 12' ladder
	Foot Action	One Foot	x							
		Feet					x			Climbing a 12' ladder,
	Fine Finger Movements				x					Pulling drill trigger, holding nails

***FREQUENCY**

SELDOM = Not always performed during completion of job

REQUIRED = Frequent Repetition for 25%-50% of job

MINOR = Performed less than 25% of job

MAJOR = Frequent Repetition for more than 50% of job

All Sectors – Ladder Worker

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations		x				
		Other Sounds		x				Potential emergency calls or alarms
	Vision	Far		x				Identifying if conduit is straight
		Near					x	Work is within arms reach at all times (Approx. 3' or less)
		Colour		x				Identifying and recognizing different types of wire
		Depth				x		Estimating how many ladder rungs one must descend to reach the floor
	Perception	Spatial – organization				x		Identifying the correct height of ladder needed to reach the overhead work
		Form - recognition				x		Identifying different tools, sizes of conduit etc.
	Feeling					x		Identifying if screws are tight based on feel
	Reading		x					
	Writing		x					
	Keying/Typing		x					
	Speech			x				
WORK ENVIRONMENT	Outside Work		x					Indoor work environment
	Hot		x					Indoor work environment (with A/C)
	Cold		x					Indoor work environment
	Humid		x					Indoor work environment
	Dry						x	Indoor work environment; not working near water
	Dust				x			Retrofitting work – dust gathers on overhead pipes and lights
	Vapour Fumes		x					
	Noise					x		Conversations in building, drilling, etc.
	Vibration	Whole Body	x					
		Upper Extremity			x			Using a drill
	Contact Stress					x		Drilling, hammering
	Striking with Hand/Fist		x					
	Moving Objects			x				The ladder can move if on uneven terrain
	Hazardous Machines		x					
	Electrical					x		Working on electrical wiring or components
	Sharp Tools			x				
	Radiant/Thermal Energy				x			Working beside or near fluorescent lighting
	Slippery		x					
	Congested Worksite						x	Pre-existing conduit, piping & lights obstructing work site
	Chemical Irritants		x					
CONDITIONS	Works Independent but in Group		x					Works independently
	Operate Equipment/Machinery		x					
	Machine Paced		x					
	Production Quotas						x	Must complete work in a timely manner
	Deadline Pressures		x					
	Irregular/Extended Hours		x					

*FREQUENCY
SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

High Rise Residential (slab, rough-in, finishing)

Date June 16, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

IBEW Sector High Rise Residential | **Job Title** Electrician | **Company** Nortown Electric

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	LOAD (object/tool) Maximum (Kg)	Usual (Kg)	COMMENTS
STRENGTH	Lifting				x			20	5	Lifting materials off floor; Loads above 23 Kg lifted by 2 workers
	Carrying						x	20	5	A tool belt is worn to carry tools – hammer, drill (approx. 5Kg); carrying conduit
	Pushing				x					Pushing conduit into plastic casings
	Pulling					x				Wire pulling through conduit
	Handling						x	20	1.5	Materials and tools handling (eg. Cordless drill)
	Throwing		x							
	Gripping	Power Grasp				x				Drilling; Tying conduit to rebar
		Pinch Grasp				x				Gripping wires; picking up small materials
	Reaching	Above Shoulder				x				Overhead work
		Below Shoulder			x					Plug installations; wire pulling
		To the Side			x					Awkward positions during overhead installations
POSTURES	Shoulder	Abduction		x						
		Flexion				x				Overhead work; Wire pulling
	Hip	Abduction			x					Used for balance during slab work
	Wrist	Flexion/Extension		x						
		Radial/Ulnar Devn				x				Conduit tying; hammer use
		Pronate/Supinate			x					Screwdriver use
	Trunk	Flexion					x			Slab work (attaching conduit to rebar), installation of plugs
		Extension			x					Overhead work; ladder work
		Side Bend			x					Overhead work; ladder work
		Twist			x					Overhead work; ladder work
	Neck	Flexion					x			Slab work, installing plugs & low level work
		Extension				x				Overhead installation of conduit, lighting fixtures
		Side Bend		x						
		Twist		x						
MOBILITY	Sitting		x							Work is performed standing, crouching or kneeling
	Standing						x			
	Walking						x			
	Climbing					x				Climbing stairs & ladders
	Crawling		x							
	Crouching				x					Putting in plug fixtures; low level finishing
	Kneeling				x					Installation of plugs
	Balancing						x			Ladder use, carrying things up stairs, uneven terrain on slab
	Foot Action	One Foot				x				Kneeling & slab work
		Feet					x			
	Fine Finger Movements					x				Selection & insertion of wire into switches, plugs, etc.

*FREQUENCY

SELDOM = Not always performed during completion of job | REQUIRED = Frequent Repetition for 25%-50% of job

MINOR = Performed less than 25% of job | MAJOR = Frequent Repetition for more than 50% of job

High Rise Residential (slab, rough-in, finishing)

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations			x			During initial organization & to organize fixture & conduit layout
		Other Sounds			x			Sound of overheard crane movement; emergency alarms
	Vision	Far				x		Past 5 feet; seeing potential obstacles, conduit layout
		Near					x	Rough-in & finishing of fixtures; conduit installation
		Colour				x		Used in installation of plugs/switches, wire identification
		Depth				x		Used in installation of plugs, switches & lighting fixtures
	Perception	Spatial – organization				x		Conduit & fixture layout during slab work
		Form - recognition				x		Distinguishing plug fixtures from switch fixtures, etc.
	Feeling						x	
	Reading				x			Initial layout of fixtures during slab
	Writing			x				Used to mark out layout of fixtures during slab
	Keying/Typing		x					
	Speech				x			Communicating work accomplished and work to be done
WORK ENVIRONMENT	Outside Work					x		Slab work & work on unfinished floors
	Hot			x				Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather.
	Cold			x				Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Outdoor slab work stops during heavy rain; work mostly in dry weather/environments
	Dust						x	Construction site; drywall dust
	Vapour Fumes				x			Oil spray used during slab work, paint
	Noise						x	Construction equipment, drilling, sawing, crane movement
	Vibration	Whole Body	x					
		Upper Extremity			x			Drilling
	Contact Stress					x		Drilling, wire pulling, etc.
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (eg. Hammer)
	Moving Objects					x		
	Hazardous Machines		x					Tools used are safe with proper protocol
	Electrical						x	
	Sharp Tools				x			Conduit cutters
	Radiant/Thermal Energy		x					
	Slippery			x				The slab can become slippery when it rains
	Congested Worksite						x	
	Chemical Irritants		x					
CONDITIONS	Works Independent but in Group						x	Work is primarily in at least groups of 2
	Operate Equipment/Machinery					x		Drills
	Machine Paced				x			Depends on work rate of other trades (eg. Iron workers)
	Production Quotas						x	Work must be done in a specific timeframe
	Deadline Pressures				x			Fairly quick, continuous work rate
	Irregular/Extended Hours			x				

*FREQUENCY
SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

Low Rise Residential (rough-in & finishing)

Date May 24, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons. Kin.)

IBEW Sector Low Rise Residential | **Job Title** Electrician | **Company** Richview Electric

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	LOAD (object/tool) Maximum (Kg)	Usual (Kg)	COMMENTS
STRENGTH	Lifting				x			18	5	Loading trucks for each site; Loads above 23 Kg lifted by 2 workers Lift start: 31 1/8" or 0"; Lift finish: 26 3/8"
	Carrying						x	18	5	A tool belt is worn to carry tools – hammer, drill (approx. 5 Kg); Carrying equipment to second floor
	Pushing					x		10	2.5	Pushing fixtures, etc. into place
	Pulling					x		3.75	2.5	Wire pulling during rough-ins
	Handling						x			Materials and tool handling
	Throwing			x						Underhand toss to place materials on the floor
	Gripping	Power Grasp				x				Wire stripping, drilling
		Pinch Grasp					x			Gripping wires, nails, etc.
	Reaching	Above Shoulder				x				Overhead light and fixture installation, wire pulling and drilling
		Below Shoulder				x				Switch, plug and fixture installation, wire pulling and drilling
		To the Side			x					Awkward positions during overhead installations
POSTURES	Shoulder	Abduction			x					
		Flexion					x			Ladder work, wire pulling, meter base installation, etc.
	Hip	Abduction			x					
	Wrist	Flexion/Extension		x						
		Radial/Ulnar Devn				x				Drill and hammer use
		Pronate/Supinate			x					Screwdriver use
	Trunk	Flexion					x			Plug installation, wire pulling, drilling, etc.
		Extension		x						
		Side Bend			x					Ladder work, overhead work
		Twist		x						
	Neck	Flexion				x				Plug fixture installation, wire pulling, drilling
		Extension				x				Overhead work
		Side Bend		x						
		Twist		x						
MOBILITY	Sitting			x						Most work is completed in the standing or crouching position
	Standing						x			
	Walking						x			
	Climbing					x				Climbing ladders and 1-2 flights of stairs
	Crawling			x						
	Crouching						x			Installation of plugs, wire pulling, picking up items on the floor
	Kneeling					x				Installing plugs, cutting vapour barrier
	Balancing					x				Ladder use; carrying items upstairs
	Foot Action	One Foot				x				While kneeling on one knee
		Feet					x			
	Fine Finger Movements					x				Selection and insertion of wires into breakers, switches, etc.

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Low Rise Residential (rough-in & finishing)

PHYSICAL DEMANDS				Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations			x			During initial organization of task distribution
		Other Sounds		x				Potential emergency calls or alarms
	Vision	Far				x		Past 5 feet; Seeing potential obstacles, wire extension, etc.
		Near					x	Used during fixture installation, breaker installation, etc.
		Colour				x		Used to distinguish “in” and “out” when wiring
		Depth				x		Used in the installation of fixtures; wire pulling
	Perception	Spatial – organization				x		Room layout, wire drilling, etc.
		Form - recognition				x		Distinguishing plug fixtures from switch fixtures, etc.
	Feeling					x		
	Reading			x				Initial reading of lighting blueprints
	Writing			x				
	Keying/Typing		x					
	Speech				x			Communicating work accomplished and work to be done
WORK ENVIRONMENT	Outside Work				x			Installing meter bases
	Hot				x			Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather.
	Cold				x			Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Work is completed in a dry, indoor environment. (Except for panel installation)
	Dust				x			Drilling and sediment on the ground; masks available
	Vapour Fumes			x				Adhesive used during meter base installation
	Noise						x	Construction equipment, drilling, hammering, etc.
	Vibration	Whole Body		x				Driving to and from the job site
		Upper Extremity					x	Drilling
	Contact Stress					x		Hammering, drilling, etc.
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (eg. Hammer)
	Moving Objects					x		
	Hazardous Machines		x					Tools used are safe with proper protocol
	Electrical						x	
	Sharp Tools			x				
	Radiant/Thermal Energy		x					
	Slippery			x				Mud around the house when it rains
	Congested Worksite					x		Extension cords, construction debris
	Chemical Irritants			x				Meter base installation adhesive; work gloves available
CONDITIONS	Works Independent but in Group						x	Work is completed with a minimum of one other person
	Operate Equipment/Machinery					x		Drills
	Machine Paced			x				
	Production Quotas						x	Must complete work in a certain cycle of time
	Deadline Pressures			x				
	Irregular/Extended Hours			x				

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Line, Utility & Traffic – General

Date July 27, 2006								**Analyst** Jennifer Yorke B. Sc. (Hons Kin)		
IBEW Sector Line & Utility - General						**Job Title** Electrician		**Company** Stacey Electric & K-Line		
PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	LOAD (object/tool) Maximum (Kg)	Usual (Kg)	COMMENTS
STRENGTH	Lifting					x		30	1 - 5	Working with tools (usually ratchets, hammers, etc.); materials handling
	Carrying					x		30	22	Unloading materials (eg. Rubber insulators for wires); carrying traffic lights & poles
	Pushing				x					Pushing pole into place during installation, pushing bolts through drill holes
	Pulling				x			85		Pulling on wire to ensure it will not droop and touch other wires or items, opening submersible lids
	Handling						x	30	1 - 5	Materials and tools handling (eg. Cordless drill)
	Throwing			x						Tossing items to electrician in the bucket approx. 8' from the ground
	Gripping	Power Grasp				x				Most bucket lift work (pole framing) is completed wearing anti-shock gloves
		Pinch Grasp			x					Connecting wiring, writing
	Reaching	Above Shoulder		x						
		Below Shoulder					x			Bucket work, shoveling, running auger
		To the Side			x					Awkward positions during bucket work
POSTURES	Shoulder	Abduction			x					Awkward positions during bucket work
		Flexion			x					Attaching new insulators to the installed pole, bolting traffic pole to new bracket
	Hip	Abduction		x						Wide stance in bucket for balance
	Wrist	Flexion/Extension			x					Using bucket controls, covering wire with insulators, writing
		Radial/Ulnar Devn				x				Hammer use, shovel use, etc.
		Pronate/Supinate		x						Screwdriver use
	Trunk	Flexion					x			Bucket work, driving to the work site, shovelling
		Extension		x						Communicating with worker in the bucket, examining pole installation from ground
		Side Bend			x					Bucket work
		Twist		x						Bucket work
	Neck	Flexion				x				Bucket work, augering, writing
		Extension		x						
		Side Bend		x						Awkward positions during bucket work
		Twist		x						Awkward positions during bucket work
MOBILITY	Sitting			x						Driving to the work location
	Standing						x			
	Walking				x					Gathering materials, walking between transformers
	Climbing			x						Climbing into and out of the bucket or truck
	Crawling		x							
	Crouching		x							
	Kneeling			x						
	Balancing					x				Bucket work - pole framing, traffic light installation
	Foot Action	One Foot		x						
		Feet					x			Standing in bucket, shoveling new fill around pole
	Fine Finger Movements				x					Connecting wires, using bucket lift controls, filling out inspection sheets

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Line, Utility & Traffic – General

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations				x		Communicating with partner regarding task at hand
		Other Sounds		x				Potential emergency calls and alarms
	Vision	Far				x		Past 5 feet; Determining if re-connected lines are straight
		Near			x			Pole framing, traffic light installation (bucket work)
		Colour			x			Wiring traffic lights, connecting wires
		Depth			x			Used in transformer inspections, light installations
	Perception	Spatial – organization				x		Straightening pole during installation
		Form - recognition			x			Identifying different bolt lengths, finding items in tool bag
	Feeling						x	Finding an item in the bucket tool bag, tightening bolts
	Reading				x			Reading work orders
	Writing				x			Filling work orders
	Keying/Typing		x					
	Speech					x		Communicating with partner on ground/in bucket
WORK ENVIRONMENT	Outside Work						x	
	Hot					x		Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather. Workers wear coveralls (& thick anti-shock gloves if working on lines)
	Cold				x			Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Outdoor work stops during heavy rain; work mostly in dry weather/environments
	Dust				x			Outdoor allergens, dust from augering
	Vapour Fumes						x	Traffic, bucket lift generator
	Noise						x	Traffic, generator to power bucket lift, augers
	Vibration	Whole Body		x				Driving to a work site
		Upper Extremity		x				Drilling
	Contact Stress					x		Drilling, hammering, loosening rusted bolts, etc.
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (ie. Hammers)
	Moving Objects						x	Traffic, bucket lift constantly moving in the wind
	Hazardous Machines			x				Tools & lift truck are safe if kept in repair
	Electrical						x	
	Sharp Tools				x			Cutting devices to strip wires, wire cutters
	Radiant/Thermal Energy		x					
	Slippery			x				Tools, the bucket, etc. can become slippery when it rains
	Congested Worksite						x	Traffic concerns
	Chemical Irritants			x				Spray used to loosen rusted bolts
CONDITIONS	Works Independent but in Group						x	Works in groups & pairs
	Operate Equipment/Machinery						x	Bucket lift, drills, auger, hydrovac
	Machine Paced				x			Bucket lift ascends/descends at a one speed, auger speed
	Production Quotas				x			Power shut offs are scheduled for certain timeframes, need for traffic control officers affects production times
	Deadline Pressures				x			Continuous work rate
	Irregular/Extended Hours			x				Emergency calls

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

Line, Utility & Traffic – Pole Installation & Framing

Date July 26, 2006 — **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

IBEW Sector Line & Utility – Pole Installation & Framing — **Job Title** Electrician — **Company** Stacey Electric & K-Line

PHYSICAL DEMANDS			Not Component	*FREQUENCY				LOAD (object/tool)		COMMENTS
				Seldom	Minor	Required	Major	Maximum (Kg)	Usual (Kg)	
STRENGTH	Lifting					x		30	1 - 5	Working with tools (usually ratchets, hammers, etc.); materials handling
	Carrying					x		30	22	Unloading materials (eg. Rubber insulators for wires)
	Pushing				x					Pushing pole into place during installation
	Pulling				x					Pulling on wire to ensure it will not droop and touch other wires or items
	Handling						x	30	1 - 5	Materials and tools handling (eg. Cordless drill)
	Throwing			x						Tossing items to electrician in the bucket approx. 8' from the ground
	Gripping	Power Grasp				x				Most bucket lift work is completed wearing thick anti-shock gloves
		Pinch Grasp			x					Connecting wiring
	Reaching	Above Shoulder		x						
		Below Shoulder					x			Bucket work, shoveling, running auger
		To the Side			x					Awkward positions during bucket work
POSTURES	Shoulder	Abduction			x					Awkward positions during bucket work
		Flexion			x					Attaching new insulators to the installed pole
	Hip	Abduction		x						Wide stance in bucket for balance
	Wrist	Flexion/Extension			x					Using bucket controls, covering wire with rubber insulators
		Radial/Ulnar Devn				x				Hammer use, shovel use, etc.
		Pronate/Supinate		x						Screwdriver use
	Trunk	Flexion					x			Bucket work, driving to the work site, shoveling
		Extension		x						Communicating with worker in the bucket, examining pole installation from ground
		Side Bend			x					Bucket work
		Twist		x						Bucket work
	Neck	Flexion				x				Bucket work, augering
		Extension		x						
		Side Bend		x						Awkward positions during bucket work
		Twist		x						Awkward positions during bucket work
MOBILITY	Sitting			x						Driving to the work location
	Standing						x			
	Walking				x					Gathering materials
	Climbing			x						Climbing into and out of the bucket or truck
	Crawling		x							
	Crouching		x							
	Kneeling			x						
	Balancing					x				Bucket work - pole framing
	Foot Action	One Foot		x						
		Feet					x			Standing in bucket, shoveling new fill around pole
	Fine Finger Movements				x					Connecting wires, using bucket lift controls

*FREQUENCY

SELDOM = Not always performed during completion of job

MINOR = Performed less than 25% of job

REQUIRED = Frequent Repetition for 25%-50% of job

MAJOR = Frequent Repetition for more than 50% of job

Line, Utility & Traffic – Pole Installation & Framing

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations				x		Communicating with partner regarding task at hand
		Other Sounds		x				Potential emergency calls and alarms
	Vision	Far				x		Past 5 feet; Determining if re-connected lines are straight
		Near				x		Pole framing (working in the bucket)
		Colour		x				
		Depth			x			Determining depth of the augered hole during pole install
	Perception	Spatial – organization				x		Straightening pole during installation
		Form - recognition			x			Identifying different bolt lengths, finding items in tool bag
	Feeling						x	Finding an item in the bucket tool bag, tightening bolts
	Reading			x				Reading work orders
	Writing			x				Filling work orders
	Keying/Typing		x					
	Speech					x		Communicating with partner on ground/in bucket
WORK ENVIRONMENT	Outside Work						x	
	Hot					x		Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather. Workers wear coveralls & thick anti-shock gloves
	Cold				x			Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Outdoor work stops during heavy rain; work mostly in dry weather/environments
	Dust				x			Outdoor allergens, dust from augering
	Vapour Fumes						x	Traffic, bucket lift generator
	Noise						x	Traffic, generator to power bucket lift, augers
	Vibration	Whole Body		x				Driving to a work site
		Upper Extremity		x				Drilling
	Contact Stress					x		Drilling, hammering, loosening rusted bolts, etc.
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (ie. Hammers)
	Moving Objects						x	Traffic, bucket lift constantly moving in the wind
	Hazardous Machines			x				Tools & lift truck are safe if kept in repair
	Electrical						x	
	Sharp Tools				x			Cutting devices to strip wires, wire cutters
	Radiant/Thermal Energy		x					
	Slippery			x				Tools, the bucket, etc. can become slippery when it rains
	Congested Worksite						x	Traffic concerns
	Chemical Irritants			x				Spray used to loosen rusted bolts
CONDITIONS	Works Independent but in Group						x	Works in groups & pairs
	Operate Equipment/Machinery						x	Bucket lift, drills, auger, hydrovac
	Machine Paced				x			Bucket lift ascends/descends at a one speed, auger speed
	Production Quotas				x			Power shut offs are scheduled for certain timeframes
	Deadline Pressures				x			Continuous work rate
	Irregular/Extended Hours			x				Emergency calls

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

Traffic – Traffic Lights & Transformers

Date July 26, 2006							**Analyst** Jennifer Yorke B. Sc. (Hons Kin)			
IBEW Sector Line & Utility – Traffic Lights & Transformers					**Job Title** Electrician		**Company** Stacey Electric & K-Line			
PHYSICAL DEMANDS			**Not Component**	***FREQUENCY** Seldom	Minor	Required	Major	**LOAD (object/tool)** Maximum (Kg)	Usual (Kg)	**COMMENTS**
STRENGTH	Lifting					x		30	1 - 5	Working with tools (usually ratchets, hammers, etc.); materials handling
	Carrying					x		30	22	Carrying traffic poles, traffic lights, etc.
	Pushing				x					Pushing bolts through drill holes, etc.
	Pulling				x			85		Opening submersible transformer lids, removing old bolts
	Handling						x	30	1 - 5	Materials and tools handling (eg. Cordless drill)
	Throwing			x						Tossing items to electrician in the bucket of the lift truck approx. 8' from the ground
	Gripping	Power Grasp				x				Loosening tight bolts, holding traffic light during installation
		Pinch Grasp			x					Writing, connecting traffic light
	Reaching	Above Shoulder		x						
		Below Shoulder					x			Bucket work, filling out inspection sheets
		To the Side			x					Awkward positions during bucket work
POSTURES	Shoulder	Abduction			x					Awkward positions during bucket work
		Flexion			x					Bolting traffic pole to bracket (bucket work)
	Hip	Abduction		x						Wide stance in bucket for balance
	Wrist	Flexion/Extension			x					Using bucket controls, writing
		Radial/Ulnar Devn				x				Hammer use, ratchet use, etc.
		Pronate/Supinate		x						Screwdriver use
	Trunk	Flexion				x				Bucket work, driving to the work site
		Extension		x						
		Side Bend			x					Bucket work
		Twist		x						Bucket work
	Neck	Flexion				x				Writing, bucket work
		Extension		x						
		Side Bend		x						Awkward positions during bucket work
		Twist		x						Awkward positions during bucket work
MOBILITY	Sitting			x						Driving to the work location
	Standing						x			
	Walking				x					Walking between transformers, gathering materials
	Climbing			x						Climbing into and out of the bucket or truck
	Crawling		x							
	Crouching		x							
	Kneeling		x							
	Balancing					x				Working on traffic lights in the bucket
	Foot Action	One Foot		x						
		Feet					x			Standing in bucket, walking between transformers
	Fine Finger Movements				x					Filling out transformer inspection sheets, connecting wires

***FREQUENCY**

SELDOM = Not always performed during completion of job
REQUIRED = Frequent Repetition for 25%-50% of job
MINOR = Performed less than 25% of job
MAJOR = Frequent Repetition for more than 50% of job

Traffic – Traffic Lights & Transformers

PHYSICAL DEMANDS				*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations				x		Communicating with partner regarding task at hand
		Other Sounds		x				Potential emergency calls and alarms
	Vision	Far				x		Past 5 feet; identifying components on submersible transformers
		Near				x		Installing traffic lights (in bucket)
		Colour			x			Wiring traffic lights, identifying the status of transformer parts
		Depth				x		Used in transformer inspections, light installations
	Perception	Spatial – organization			x			Redirecting traffic with pylons, identifying transformer components
		Form - recognition				x		Identifying different bolt lengths, finding items in tool bag
	Feeling						x	Finding an item in the bucket tool bag, tightening bolts
	Reading				x			Reading work orders, transformer inspection sheets
	Writing				x			Filling out transformer inspection sheets, work orders
	Keying/Typing		x					
	Speech					x		Communicating with partner on ground/in bucket
WORK ENVIRONMENT	Outside Work						x	
	Hot				x			Average max. temp. (for the GTA) in July is 29C. Work continues during hot weather.
	Cold				x			Work continues during the winter months – extreme cold limits ability to work
	Humid				x			Usually the weather is humid during the summer months – work continues during humid weather
	Dry						x	Outdoor work stops during heavy rain; work mostly in dry weather/environments
	Dust				x			Outdoor allergens
	Vapour Fumes						x	Traffic, bucket lift generator
	Noise						x	Traffic, generator to power bucket lift, mechanical tools
	Vibration	Whole Body		x				Driving to a work site
		Upper Extremity		x				Drilling
	Contact Stress					x		Drilling, hammering, loosening rusted bolts, etc.
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (ie. Hammers)
	Moving Objects						x	Traffic, bucket lift constantly moving in the wind
	Hazardous Machines			x				Tools & lift truck are safe if kept in repair
	Electrical						x	
	Sharp Tools				x			Cutting devices to strip wires, wire cutters
	Radiant/Thermal Energy		x					
	Slippery			x				Tools, the bucket, etc. can become slippery when it rains
	Congested Worksite						x	Traffic concerns
	Chemical Irritants			x				Spray used to loosen rusted bolts
CONDITIONS	Works Independent but in Group						x	Works in pairs – one in the bucket, one on the ground
	Operate Equipment/Machinery						x	Bucket lift, drills
	Machine Paced			x				Bucket lift ascends/descends at a one speed
	Production Quotas					x		Traffic lights must be completed in a certain timeframe due to need for traffic control officers
	Deadline Pressures				x			Continuous work rate
	Irregular/Extended Hours		x					

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

Communication Sector

Date December 18, 2006 | **Analyst** Jennifer Yorke B. Sc. (Hons Kin)

Department Communications | **Job Title** Electrician | **Company** Symtech

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	LOAD (object/tool) Maximum (Kg)	Usual (Kg)	COMMENTS
STRENGTH	Lifting				x			20	5	Lifting materials off floor; Loads above 23 Kg lifted by 2 workers
	Carrying						x	20	5	Carrying boxes of wire; ladders
	Pushing			x						Punching down
	Pulling						x			Wire pulling
	Handling						x			Materials handling (eg. wire pulling)
	Throwing			x						Throwing fish line for pulling wire
	Gripping	Power Grasp				x				Wire pulling
		Pinch Grasp				x				Inserting wire into punch panel
	Reaching	Above Shoulder				x				Overhead work
		Below Shoulder			x					Cabinet work, desk termination
		To the Side		x						Awkward positions during overhead installations
POSTURES	Shoulder	Abduction		x						
		Flexion					x			Overhead work; Wire pulling
	Hip	Abduction		x						
	Wrist	Flexion/Extension			x					Punching down
		Radial/Ulnar Devn			x					Wire pulling
		Pronate/Supinate		x						
	Trunk	Flexion					x			Wire pulling; overhead work; cabinet work
		Extension			x					Wire pulling (overhead or ground work)
		Side Bend			x					Wire pulling (overhead or ground work)
		Twist			x					Wire pulling (overhead or ground work)
	Neck	Flexion			x					Desk termination
		Extension			x	x				Wire pulling (overhead and ground work)
		Side Bend			x					
		Twist		x						
MOBILITY	Sitting		x							Work is performed standing, crouching or kneeling
	Standing						x			
	Walking						x			
	Climbing					x				Climbing ladders
	Crawling		x							
	Crouching			x						Desk termination
	Kneeling			x						Desk termination
	Balancing					x				Ladder use
	Foot Action	One Foot		x						Kneeling
		Feet					x			
	Fine Finger Movements					x				Selection & insertion of wire into plugs, punch panel

*FREQUENCY

SELDOM = Not always performed during completion of job

MINOR = Performed less than 25% of job

REQUIRED = Frequent Repetition for 25%-50% of job

MAJOR = Frequent Repetition for more than 50% of job

Communication Sector

PHYSICAL DEMANDS			Not Component	*FREQUENCY Seldom	Minor	Required	Major	COMMENTS
SENSORY/PERCEPTUAL	Hearing	Conversations			x			During initial organization
		Other Sounds		x				Sound of emergency alarms
	Vision	Far				x		Past 5 feet; seeing potential obstacles, wire pulling
		Near			x			Punching down, desk termination
		Colour			x			Wire identification and punching down
		Depth				x		Used in wire pulling and punching down
	Perception	Spatial – organization				x		Determining wire length needed during layout
		Form - recognition		x				
	Feeling						x	
	Reading				x			Continuously checking the blueprints to ensure accurate communications layout
	Writing			x				Used to mark wires and boxes for communication layout
	Keying/Typing		x					
	Speech						x	Communicating when wire pulling and on work to be done
WORK ENVIRONMENT	Outside Work		x			x		Indoor worksites
	Hot		x					Indoor worksites (temperature regulated)
	Cold		x					Indoor worksites (temperature regulated)
	Humid		x					Indoor worksites (temperature regulated)
	Dry						x	Indoor worksites
	Dust					x		Drywall dust
	Vapour Fumes			x				Paint, wall compound
	Noise						x	Construction, drilling, sawing, hammering, etc.
	Vibration	Whole Body	x					
		Upper Extremity	x					
	Contact Stress						x	Punching down, wire pulling, etc.
	Striking with Hand/Fist		x					Striking is accomplished with hand tools (eg. Hammer)
	Moving Objects				x			
	Hazardous Machines		x					Tools used are safe with proper protocol
	Electrical					x		
	Sharp Tools				x			Punch down tools, tray edges
	Radiant/Thermal Energy		x					
	Slippery		x					Indoor worksites
	Congested Worksite					x		
	Chemical Irritants		x					
CONDITIONS	Works Independent but in Group						x	Work is primarily in groups of 2 or independently
	Operate Equipment/Machinery			x				Hand tools are used (eg. punch down tool)
	Machine Paced		x					
	Production Quotas						x	Work must be done in a specific timeframe
	Deadline Pressures				x			Fairly quick, continuous work rate
	Irregular/Extended Hours			x				

*FREQUENCY

SELDOM = Not always performed during completion of job
MINOR = Performed less than 25% of job
REQUIRED = Frequent Repetition for 25%-50% of job
MAJOR = Frequent Repetition for more than 50% of job

Prepared by: Jennifer Yorke B. Sc. (Hon. Kin.)
Supervised by: Syed Naqvi – PhD CCPE (Ergonomist, OHCOW) & Gary Majesky (IBEW L.U. 353)

Electrician's Job Demands

Communication Sector

Photographs

Discomfort Survey Results

Purpose

IBEW contacted the Occupational Health Clinics for Ontario Workers (OHCOW) to conduct a health and musculoskeletal discomfort/symptom survey of its membership. The objective was to provide a snapshot of various classifications experiencing pain and discomfort for action priorities. The focus of the survey included basic demographics and musculoskeletal discomfort in various body parts, assessment of level of discomfort, and frequency of discomfort.

Results and Analysis

The survey yielded a number of key findings. Results of the discomfort survey for male and female, full-time, part-time, and other workers reporting in various classifications are presented in this report. Most of the respondents with respect to classifications came from ICI (81.3%) followed by High Rise (9%). Respondents working for (more than 10 years) were the biggest reporting group (58.2%) followed by 3-6 years group (10.7%) and less than 6 months (10.4%) and so on.

MUSCULOSKELETAL HEALTH

- **Have you, in the last 12 months, sought a health care professional's advice about pain in any of these parts of the body?** ***(response rate 100%)***

Neck	**72 (22.9%)**	Wrists/Hands	**98 (31.1%)**	Hips/Thighs	**50 (15.9%)**
Shoulders	**99 (31.4%)**	Lower Back	**119 (37.8%)**	Knees	**111 (35.2%)**
Elbows	**51 (16.2%)**	Upper Back	**49 (15.6%)**	Ankle(s)/Feet	**66 (21.0%)**

- **Did you take any time off in the last 12 months because of problems that you believe to be work related, with any of these parts of the body?** ***(response rate 100%)***

Neck	**18 (5.7%)**	Wrists/Hands	**29 (9.2%)**	Hips/Thighs	**11 (3.5%)**
Shoulder(s)	**30 (9.5%)**	Lower Back	**41 (13.0%)**	Knees	**39 (12.4%)**
Elbow(s)	**10 (3.2%)**	Upper Back	**13 (4.1%)**	Ankle(s)/Feet	**23 (7.3%)**

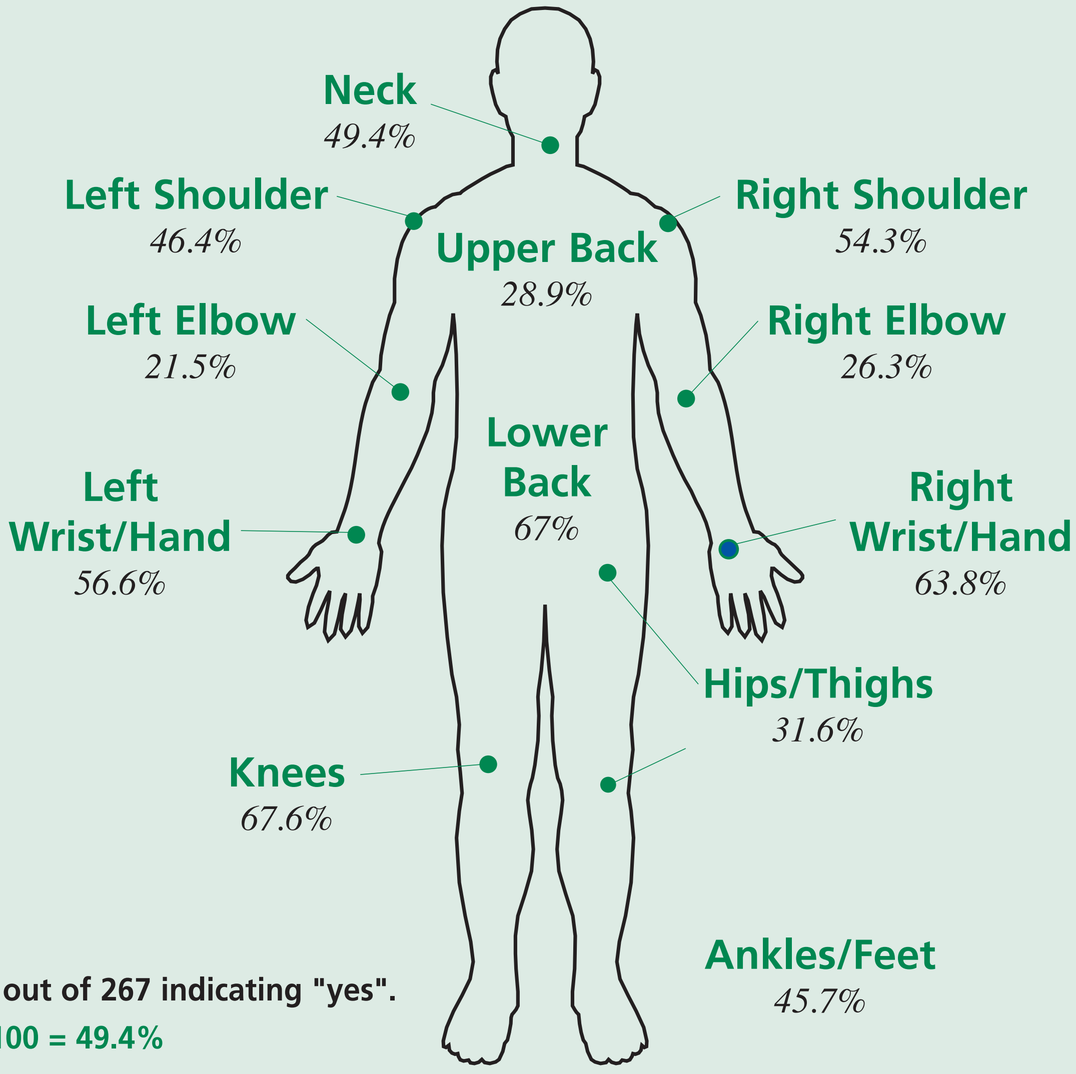
- **If YES, did you report to the company?** ***(response rate 52.1%)***

Yes **79 (48.2%)** No **85 (51.8%)**

- **Was it reported to the WSIB?** ***(response rate 52.4%)***

Yes **65 (39.4%)** No **100 (60.6%)**

Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) that you believe to be work related, with any of these areas of the body?



Example:
Neck – 132 out of 267 indicating "yes".
132/267 x 100 = 49.4%

Special Thanks

To all our members, volunteers, and everyone who took part and made our April 23rd 2005 Occupational Health Clinic a great success!

Acknowledgements:

James Gribben, Research Assistant
Howard McFadden, Health & Safety Committee
Gary Majesky, LU 353 WSIB Service
John Smith & James St. John, Toronto Building Trades Council
Pat Dillon & Carmen Tiano, Provincial Building Trades Council
Wayne Samuelson & Irene Harris, Ontario Federation of Labour
OHCOW, Toronto Office
Workplace Safety and Insurance Board

Patient Notes:

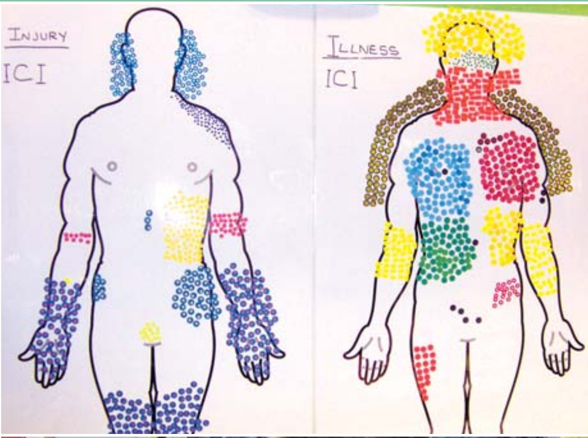
Project Manager
Gary Majesky
WSIB Consultant

Thank-you to our members and contractors that participated

IBEW Local 353

Makes a difference in people's lives

Someone in your corner



IBEW LU 353

1377 Lawrence Ave. East
Toronto, ON M3A 3P8
T: (416) 510-3530
F: (416) 510-3531

Find out more at: www.ibew353.org