Prepared by: Jennifer Yorke B.Sc. (Hons. Kin.)
Completed: August 18, 2006

Low Rise Residential Task Analysis

Job Task Description	Brief Task Analysis	Photo of Task
Materials Handling - Gather items listed for job from "Materials Needed" sheet - Lift items into truck - Drive truck to site - Carry items into the house at the site - Load leftover material into truck and return to shop	- Items lifted individually are a max. weight of 18 Kg. Materials above 23 Kg are to be lifted by at least 2 workers as per NIOSH standards [1] - Materials handling is concentrated at the beginning and end of low rise wiring work, therefore there is adequate time for muscular recovery between materials handling tasks as they are low repetition [2] - Maximum lift height of 26 3/8" – below shoulder height allowing for maximum muscular force production and low risk of injury [5] - Driving for approx. 30 min/trip - A cluttered worksite & wet weather increase the potential for falls when handling materials [3]	
Reading & Drawing Blueprints - Get blueprints from supervisor - At the site: From blueprints, mark where plugs & switches will be with a marker	- Only natural lighting is available for this task. CCOHS recommends a lighting value of at least 100 lux. (This will prevent squinting). Flashlight use on overcast days is helpful [4] - All switches and plugs are marked on studs at chest height (approx. 5') - Task requires thought, but minimal physical exertion	
Wire Pulling - Hammer nails partway into wooden studs - Slide wire spools into metal rod - Lift rod & spools onto nails; hammer down nails - Drill holes in wooden studs with drill - Pull end of wire on spool; cut end of wire - Slide wire end through pre-drilled holes - Pull wire through multiple holes	- Over 50% of work is completed with a flexed spine (lumbar & cervical). A flexed spine has a decreased ability to withstand shear and compressive forces, increasing the risk of a spinal injury [5] - 30% (15 - 20 min) of drilling is overhead. Overhead work places increased force on the shoulder, cervical and thoracic spine increasing the risk for ligament and muscular damage [11] - 50 – 65 min of drilling - CCOHS recommends reducing continuous vibration to the body as much as possible through rest, anti-vibration gloves & tool re-design to reduce potential for hand-arm vibration injuries [6] - Force to push drill = 10.6 Kg - Drilling requires static contraction of shoulder & forearm musculature	 

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	Prolonged static contraction can cause muscle fatigue & injury as blood flow is constricted [2] - Pulling approx. 1000' of wire/house - Wire pulling is a forced repetitive shoulder extension with the spine in a flexed position. Prolonged periods of this activity increase the risk of shoulder & spinal injury - Minimal hammer work - Lifting of spools done with a partner	
Plug and Switch Installation – Rough In - Roll vapour barrier out on the floor; cut pieces approx. 1-2' square - Bring plug/switch fixtures to the installation site - Nail vapour barrier to the stud (if on an outside wall) - Nail the fixture to the stud - Thread wire through the back of the fixture	- Crouching/kneeling to cut vapour barrier (approx. 3 min). Minimal exertion task - Task involves nailing 120 – 220 nails. Chengalur et al., 2004 recommends a limit of 2 hours of cumulative hammering/day [7] - Over 60% of nailing (installing plugs) is completed with a flexed spine (lumbar & cervical). A flexed spine has a decreased ability to withstand shear and compressive forces, increasing the risk of a spinal injury [5] - Switch installation occurred at approx. 48" from floor	
Meter Base Installation - Drill 4 holes in outside wall for the meter box (Glass of meter box must be 5'8" high) - Screw/drill meter box into the side of the house - Cut tubing using a handsaw - Coat ends of tubing with adhesive and attach them to the meter box - Drill holes for brackets mounting the tubing to the wall - Screw/drill brackets into the wall	- Drilling produces dust – inhalation can be minimized through use of a mask - Minimal force is required to saw through tubing – a light task - Adhesive used to secure tubing joints is toxic; work is completed outside in an open area - Drilling approx. 12 holes into brick or concrete per meter base - CCOHS recommends reducing continuous vibration to the body as much as possible through rest, anti-vibration gloves & tool re-design to reduce potential of hand-arm vibration injuries [7] - Drilling in all postures – above shoulder, at chest height, in a crouch - 6-14 meter base installs/day - Awkward postures due to uneven terrain places workers at risk for injury - Drilling requires static contraction of shoulder & forearm musculature.	

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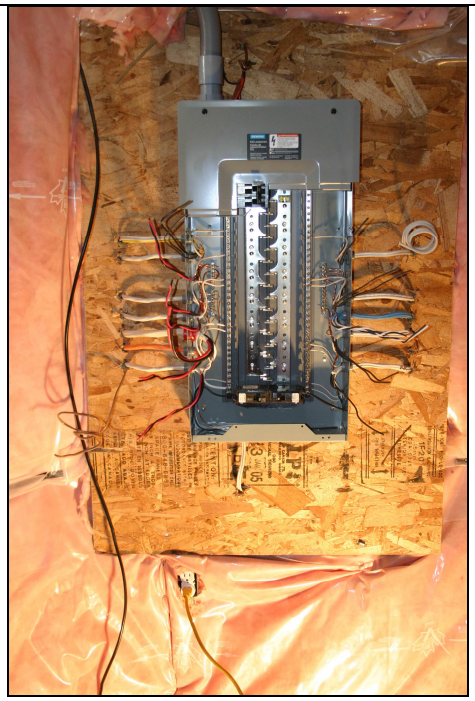
	Prolonged static contraction – can cause muscle fatigue & injury as blood flow is constricted [2]	
Panel Installation - Bring needed materials to the basement (Panel box, ladder, plywood) - Frame the panel box - Nail plywood to framing - Drill through masonry into the basement - Use adhesive to connect a U-tube in the basement to the outside meter base tubing - Screw the panel to the plywood in the basement; attach panel to the U-tube - Thread 3-All wiring through the tubing into the house (3 wires) - Connect 3-All wires to the meter base connectors - Install a plug directly beneath the panel - Place cover on meter base - Place cover on panel box	- Panel installation may be completed with one or two workers - Workers may have difficulty bringing needed materials to the basement as stairs may not yet be installed - Minimal use of screwdriver - Drilling through masonry requires high amounts of force and sustained contraction. May be in an awkward position during drilling due to uneven terrain, which increases the potential for injury. - Prolonged static contraction can cause muscle fatigue & injury as blood flow is constricted [2] - Drill –potential for a vibration injury if there is not enough rest between each use [2, 6] - Nailing into concrete (during framing) and wood. Chengalur et al., 2004 recommend a limit of 2 hours of cumulative hammering/day. Increased force used to nail into concrete raises potential for injury [7] - Adhesive used is toxic; work area should be ventilated properly - Maximal effort: Inserting the 3-All wire into the tubing. Awkward posture – overhead pulling, which places the shoulder at risk for an injury due to end range of motion and high force - Difficult to bend/strip/cut 3-All wire to connect it to the meter base. Requires maximal effort to bend the wire. Work is completed in awkward postures (uneven terrain) increasing the risk for injury. Difficulty cutting wire is minimized with correct tools (wire cutter with ratchet ability) [11]	

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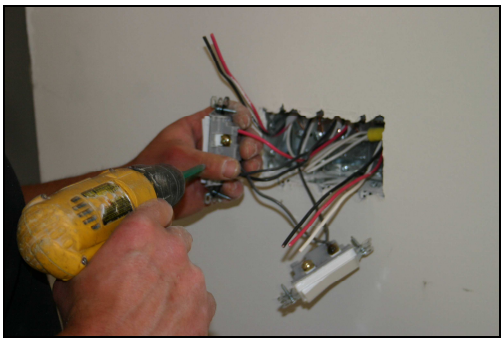
Job Task Description	Brief Task Analysis	Photo of Task
Switch & Plug Fixture Installation – Finishing - Bring switch/plug to the unfinished fixture - Pull wire out of the fixture - Strip approx. ½" of wire - Use screwdriver/drill to unscrew screws of plug/switch - Insert stripped wires; screw/drill in the screws until they are tight - Place switch/plug into the fixture hole - Screw/drill the switch/plug into place - Screw on plate	- Approx. 1 ½ - 2 min to complete one switch/plug installation - Approx. 72 plugs/switches per house - Stripping wire: Wrist in ulnar deviation; firm hand grasp with quick extension of wrist - Approx. 1 – 1 ½ min between each repetition minimizing fatigue build up, however the wrist is in ulnar deviation, which is an unwanted posture [2, 8] - Either a screwdriver or drill is used for securing screws. - Screwdriver – Repetitive supination / pronation of wrist increasing potential for a wrist/forearm injury [2] - Drilling –potential for a vibration injury if there is not enough rest between each use. Moderate drilling: for every 3 sec of drilling, a worker requires 2 sec of rest [7] - Over 50% of task (installing plugs) is completed with a flexed spine (lumbar & cervical). A flexed spine has a decreased ability to withstand shear and compressive forces, increasing the risk of a spinal injury [5]	 
Light Fixture Installation – Finishing - Bring light to the unfinished fixture - Climb ladder to the fixture - Pull wire out of the fixture - Strip approx. ½" of wire - Screw in bracket - Use screwdriver/drill to unscrew screws of light fixture - Insert stripped wires; screw/drill in the screws until they are tight - Screw/drill the light holder into place - Install bulb & attach globe	- Approx. 2 – 2 ½ min to complete a light installation - Overhead work - Shoulders, cervical & thoracic spine experience increased compressive and shear forces from static contraction. Prolonged static contraction can cause muscle fatigue & injury as blood flow is constricted. Overhead work also fatigues muscles faster than work below shoulder level, increasing the potential for injury [2] - Worker must ascend/descend a 4 – 12' ladder. Potential for falls. Also, the worker may experience muscular fatigue from continuously bracing & balancing themselves while on the ladder increasing injury potential [9] - Stripping wire: Wrist in ulnar deviation; firm hand grasp with quick extension of wrist - Approx. 2 – 2 ½ min between each repetition minimizing fatigue build up, however the wrist is in ulnar deviation, which is an unwanted posture [2, 8]	

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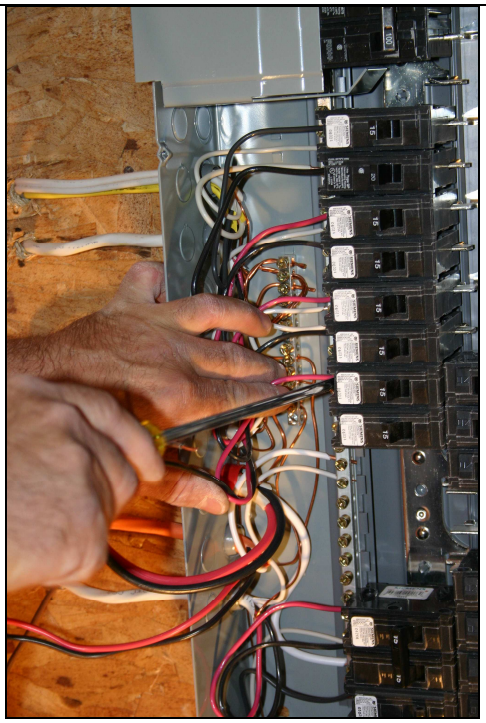
	- Either a screwdriver or drill is used for securing screws. - Screwdriver – Repetitive supination / pronation of wrist increasing potential for a wrist/forearm injury [2] - Drilling –potential for a vibration injury if there is not enough rest between each use. Moderate drilling: for every 3 sec of drilling, a worker requires 2 sec of rest [6, 7]	
Breaker Panel – Finishing - Remove cover screws - Pull out all wires - Get the appropriate breakers - Insert breakers in the panel - Strip wires & insert wires into breakers - Tighten breaker screws - Tuck wires back into the panel - Remove appropriate number of metal squares from panel cover for breakers - Re-screw cover to the breaker panel	- Work is at chest level - Stripping wire: Wrist in ulnar deviation; firm hand grasp with quick extension of wrist - Approx. 2 – 2 ½ min between each repetition minimizing fatigue build up, however the wrist is in ulnar deviation, which is an unwanted posture [2, 7] - Either a screwdriver or drill is used for securing screws - Screwdriver – Repetitive supination / pronation of wrist increasing potential for a wrist/forearm injury [2] - Drilling: –potential for a vibration injury if there is not enough rest between each use. Moderate drilling: for every 3 sec of drilling, a worker requires 2 sec of rest [6, 7] - Breaking off the metal squares from the panel cover requires repetitive flexion/extension of the wrist – potential for injury if multiple panels are completed each day [10]	
Pre-Delivery Inspection (PDI) - Receive a sheet of deficiencies from contractor - Perform listed tasks (eg. Connect a range hood; install photo sensor)	- Physical demands vary - PDI accounts for less than 1% of usual work activity	

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References

1. National Institute for Occupational Health and Safety (2005, September 7). *Recommendations to Improve Safety in Potato Harvesting and Packing in Southern Colorado.* Retrieved June 21, 2006, from http://www.cdc.gov/niosh/pot_lift.html

2. Chengalur, S.N., Rodgers, S. & Bernard, T. (2004). *Kodak's Ergonomic Design for People at Work*. New York: John Wiley & Sons, Inc. (pp. 113-115, 449-462)

3. Lehtola, C., Becker, W. & Brown, C: National AG Safety Database (2001, February). *Preventing Injuries from Slips, Trips & Falls*. Retrieved June 21, 2006, from http://www.cdc.gov/nasd/docs/d000001-d000100/d000006/d000006.html

4. Canadian Center for Occupational Health and Safety (2003, January 27). *Lighting Ergonomics – General*. Retrieved June 21, 2006, from http://www.ccohs.ca/oshanswers/ergonomics/lighting_general.html

5. McGill, S. (2002). *Low Back Disorders: Evidence-Based Prevention and Rehabilitation*. Ontario: Human Kinetics. (pp. 36-101)

6. Canadian Center for Occupational Health and Safety (1998, October 30). *Vibration – Measurement, Control and Standards*. Retrieved June 21, 2006, from http://www.ccohs.ca/oshanswers/phys_agents/vibration/vibration_measure.html

7. Chengalur, S.N., Rodgers, S. & Bernard, T. (2004). *Kodak's Ergonomic Design for People at Work*. New York: John Wiley & Sons, Inc. (pp. 143-144, 617-629)

8. Canadian Center for Occupational Health and Safety (2000, December 6). *Tool Design*. Retrieved June 21, 2006, from http://www.ccohs.ca/oshanswers/ergonomics/handtools/tooldesign.html

9. Kumar, S. (2001). *Biomechanics in Ergonomics*. Philadelphia: Taylor & Francis Inc. (pp. 335-346)

10. Kilbom, A. (1994). High Risk Repetition Rates by Different Body Parts. *International Journal of Industrial Ergonomics,* 14, 59-86.

11. 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. (pp. 164-165).