

## TASK ANALYSIS WORKSHEET

Company: The Corporation of DeltaDepartment: Engineering OperationsJob Title: Equipment Operator III (Sweeper) – Elgin Ford #2108Date: September 17, 2003**Job Summary:**

The Sweeper Operator is primarily responsible for sweeping roads throughout the Delta area. Personal protective equipment include: safety boots and coveralls. This assessment focused on the operation of the Elgin Ford #2108 sweeper. For some tasks, the assessment will draw from RA-Sweeper assessment (dated April 16/23 2003) as indicated. All sweepers allow for both right-hand and left-hand driving.

The operator stated that the time spent sitting on each side (i.e. left side vs. right side) varies from day to day. The operator estimated that he drives on the right side 60% of the time and on the left side ~40% of the time. For safety reasons, operators have been instructed to sit on the left side when: i) driving from location to location (i.e. when not sweeping); and ii) when sweeping medians (which are located on the left).

This assessment includes the following tasks (and the Sweeper it was assessed on):

1. Parking Brake (Elgin Ford #2108)
2. Lifting Hood during pre-trip inspection (Elgin Ford #2108)
3. Operating control panel (Elgin Ford #2108)
4. Driving (Elgin Ford #2108) – *watched mock-up, not actual driving task*
5. Filling water tank using a hydrant (Elgin GMC #2073) - *drawn from RA – Sweeper assessment (dated 04/16/03)*
6. Cleaning truck using water hose (Elgin Crosswind) - *drawn from RA – Sweeper assessment (dated 04/16/03)*

**Other Notes:**

- The purpose of this assessment was to assess specific tasks that require forceful exertions or awkward postures with the left shoulder (employee recently complained of left shoulder discomfort on this job). As a result, NOT all tasks performed by the Sweeper Operator were assessed.
- N.B: This assessment was based on a working population of males only.

Tasks & Description of Activities

1. Parking Brake (Elgin Ford #2108)

- Parking brake is an air brake and is applied each time the operator gets out of the cab.
- The parking brake, which can be applied / released from the left seat or the right seat, requires a pull (to apply the air brake) and a push (to release the air brake).



Parking Brake location (shown in red)

2. Lifting / Lowering Hood during Pre-trip Inspection (Elgin Ford #2108)




Steps to raise hood:

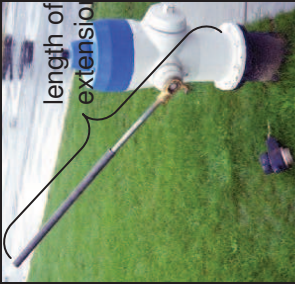



- i. Open doors – minimal forces required
- ii. Insert cab lock handle into orange receiver and turn counter clockwise
- iii. Push black knob
- iv. Release hook
- v. Raise / lift hood (i.e. fully tilt cab)

Steps to close hood:

- i. Close door(s) to reduce weight
- ii. Raise cab slightly (using right arm) and pull stay arm from center pivot
- iii. Lower / pull down hood

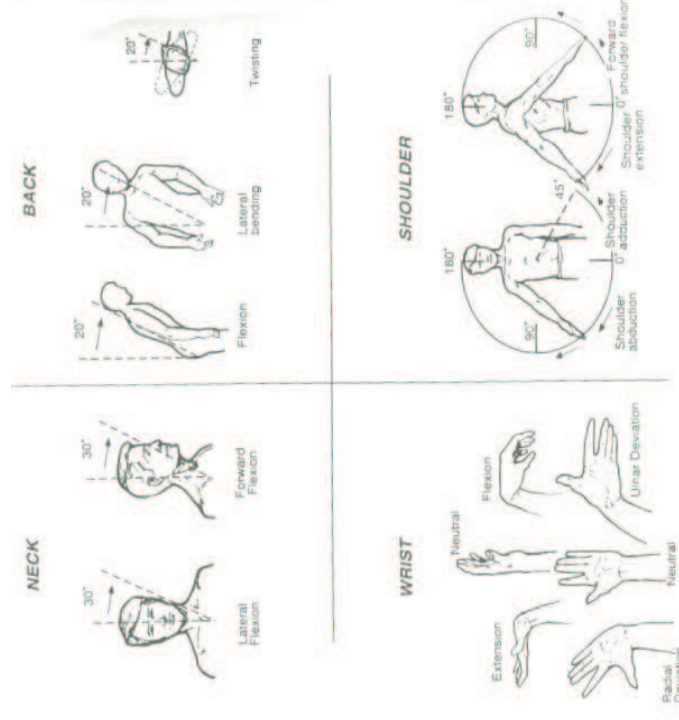


Tasks & Description of Activities	
<p><b>3. Operating Control Panel (Elgin Ford #2108)</b></p> <ul style="list-style-type: none"> <li>▪ Control panel tilts and swivels</li> <li>▪ Employee usually sits on right side of sweeper and, therefore, operates the control with the left arm most of the time</li> <li>▪ Minimal forces for controls (&lt; 3 lbs force)</li> </ul>	<div style="display: flex; justify-content: space-around;">   </div> <p style="text-align: center;">Operating control panel</p> <p style="text-align: center;">Control panel</p>
<p><b>4. Driving (Elgin Ford #2108)</b></p> <ul style="list-style-type: none"> <li>▪ Steering wheel does not move forward or tilt</li> <li>▪ Seat does move forward – however, depending on height of employee, may be unable to move too close due to location of pedals</li> </ul>	 <p style="text-align: center;">Steering wheel (right side)</p>

Tasks & Description of Activities	
<p><b>5. Filling water tank using a hydrant (Elgin GMC #2073)</b></p> <ol style="list-style-type: none"> <li>i. Remove tools (independent gate valve, hydrant key, extension) from tool box</li> <li>ii. Loosen cap using hydrant key (+ extension)</li> <li>iii. Remove cap by hand (after loosening with tools)</li> <li>iv. Hand-tighten independent gate valve onto hydrant. Independent gate valve releases the water.</li> <li>v. Tighten independent gate valve onto hydrant using hydrant key (+ extension)</li> <li>vi. Open hydrant using hydrant key (+ extension)</li> <li>vii. Secure water hose to independent gate valve using hydrant key (+ extension)</li> <li>viii. Fill water tank on sweeper</li> <li>ix. Loosen water hose using hydrant key (+ extension)</li> <li>x. Close the hydrant using hydrant key (+ extension)</li> <li>xi. Loosen independent gate valve using hydrant key (+ extension)</li> <li>xii. Secure cap onto hydrant using hydrant key (+ extension). Operator stated that the cap does not have to be secured very tight – just enough so that it cannot be removed by hand.</li> </ol>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>length of hydrant key (+ extension) 107 cm</p> </div> <div style="text-align: center;">  <p>Independent gate valve</p> </div> <div style="text-align: center;">  <p>Secure water hose to hydrant.</p> </div> </div> <p>Using hydrant key to loosen cap      Using hydrant key to open / close hydrant</p>
<p><b>6. Cleaning truck using water hose (Elgin Crosswind)</b></p>	 <p>Cleaning truck using hose</p>

**Risk Factors considered:**

- Joint posture: wrist, elbow, shoulder, neck, back, knees
- Awkward posture: reach, twist, bend, stoop, squat, climb, static, dynamic
- Force: lift, lower, carry, push/pull, pinch or power grip
- Repetition: frequency, duration
- Contact Stress
- Object weight, location, size, shape, handles, stability of load
- Work height, layout, seating, space
- Tool/equipment use
- Environment: layout, flooring, temperature, noise, light, glare, vibration
- Work Organization: recovery, schedule, workload, task variability, pace, PPE use, interruptions



*Postures, WCB of BC*

<b>Department/Work Area:</b> Engineering Operations, Roads Traffic	<b>Occupation:</b> Equipment Operator III (Sweeper)
<b>Specific Location:</b> Delta (assorted)	<b>Contact Name</b>
<b>Assessed By:</b> F. Ismail	<b>Assessment Date:</b> September 17, 2003

<b>Description of work area:</b> Outdoor roadside urban and industrial park location.
<b>Hours of Work/Shift Schedule:</b> 7:00 a.m. to 3:30 p.m.
<b>MSI signs / symptoms noted:</b> left shoulder

Frequency percentages are based on NIOSH and Department of Labour guidelines.

<b>Tasks for Ergonomics Risk Assessment (from Task Analysis worksheet):</b>		<b>Frequency / Duration of Task:</b>
1. Parking Brake – Elgin Ford #2108		< 1 hour/day
2. Lifting / lowering hood during pre-trip inspection – Elgin Ford #2108		< 1 hour/day
3. Operating Control Panel – Elgin Ford #2108		< 1 hour/day
4. Driving – Elgin Ford #2108		up to 5 hours / day
5. Filling water tank using a hydrant – Elgin GMC #2073		< 1 hour/day
6. Cleaning truck using water hose – Elgin Crosswind		< 1 hour/day

The following tasks are described based on observations of the worker performing the tasks. Other workers may assume different body postures when performing the task.

<b>Task</b>	<b>Risk Factors</b>	<b>Freq/Dur</b>	<b>Mag/Range</b>	<b>Assessment/Observations/Comments</b>
<b>1. Parking Brake (Elgin Ford #2108)</b>	Awkward Posture: Seated on <u>RIGHT</u> side: <ul style="list-style-type: none"> <li>▪ Left shoulder abduction 20°</li> <li>▪ Left elbow extended 170°</li> <li>▪ Left wrist extended</li> </ul>	2-5 sec duration  0-33% of shift	Dynamic (<30 sec.)  Reaches: <ul style="list-style-type: none"> <li>▪ lateral reach 25 cm</li> <li>▪ vertical height – 38-48 cm below shoulder (depends on chair height)</li> </ul>	<ul style="list-style-type: none"> <li>▪ To pull / push the parking brake while seated on the RIGHT side, the following postures are assumed: left shoulder abduction 20°, left elbow extended 170° and wrist extended.</li> </ul> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
<b>Identification</b>	Force: <ul style="list-style-type: none"> <li>▪ Pull parking brake</li> <li>▪ Push parking brake</li> </ul>	2-5 sec  0-33% of shift	<ul style="list-style-type: none"> <li>▪ 5 kg pull</li> <li>▪ 13 kg push</li> </ul>	<ul style="list-style-type: none"> <li>▪ Majority of the forces to push / pull the parking brake while seated at the RIGHT side are exerted by the elbow.</li> </ul> <p>While seated at the RIGHT side: i) pulling the parking brake is within ergonomic guidelines (Kodak, 1986, Putz-Anderson, 1988); and ii) pushing the parking brake <b>exceeds</b> ergonomic guidelines (Kodak, 1986, Putz-Anderson, 1988).</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
<p><b>2. Lifting / Lowering hood during pre-trip inspection (Elgin Ford #2108)</b></p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> <li>▪ Shoulder flexion or abduction 60-180°</li> <li>▪ Elbow extension 110-180°</li> <li>▪ Wrist extension</li> <li>▪ Back twist</li> </ul>	<p>2-5 sec duration 0-33% of shift (once per shift)</p>	<p>Dynamic (&lt;30 sec.)</p>	<p><b>Assessment</b></p> <p>TO LIFT HOOD:</p> <ul style="list-style-type: none"> <li>▪ Open doors (ht. = 150 cm; minimal reach)</li> <li>▪ Shoulder flexion 60° and elbow extended 110° to insert cab lock handle into orange receiver and turn counter clockwise (ht. = 142 cm, minimal reach)</li> <li>▪ Push black knob (ht. = 137 cm)</li> <li>▪ Initially, elbows flexed &lt;90° to lift cab. At end of lift, shoulders flexed 180° and elbows extended 180°.</li> </ul> <p>TO LOWER HOOD:</p> <ul style="list-style-type: none"> <li>▪ Raise cab slightly with right arm (ht. = 189 cm.) with right arm – shoulder flexion 170°, elbow extended 180° and wrist extended</li> <li>▪ Then, pull stay arm (ht. = 114 cm, horizontal reach = 66 cm) with left hand – slight back twisting, shoulder flexion / adduction, elbow extended</li> <li>▪ Lower cab and slam shut (ht. = 150 cm)</li> </ul> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p><b>Identification</b></p> <p><b>Lifting / Lowering hood during pre-trip inspection (Elgin Ford #2108) ... continued</b></p>	<p>Force:</p> <ul style="list-style-type: none"> <li>▪ Turn cab lock handle</li> <li>▪ Push black knob</li> <li>▪ Lift and lower hood</li> <li>▪ Pull stay arm</li> </ul>	<p>2-5 sec 0-33% of shift (once per shift)</p>	<p>TO LIFT:</p> <ul style="list-style-type: none"> <li>▪ 34 kg to turn cab lock handle</li> <li>▪ 7.9 kg to push black knob</li> <li>▪ lift hood up to 32 kg</li> </ul> <p>TO LOWER:</p> <ul style="list-style-type: none"> <li>▪ 4.5 kg pull stay arm</li> <li>▪ lower hood – forces could not be obtained</li> </ul>	<p style="text-align: center;"><b>Assessment</b></p>	<p>TO LIFT:</p> <ul style="list-style-type: none"> <li>▪ Turn cab lock handle counter clockwise – 34 kg (note: force is applied fast – force may not be accurate, i.e. may include jerky movement. Employee stated that this task does <u>not</u> require a high force exertion).</li> <li>▪ Push black knob – 7.9 kg (horizontal push forward)</li> <li>▪ lift hood up to 35 kg (vertical pull up then push up) – can use 2 hands for this task (note: force is usually applied quickly – for purposes of measurement, force was applied slowly – force may not be accurate).</li> </ul> <p>TO LOWER:</p> <ul style="list-style-type: none"> <li>▪ Pull stay arm – 4.5 kg (horizontal abduction)</li> <li>▪ To lower hood – initially pull down then push down</li> </ul> <p>The following forces are within ergonomic guidelines: i) push black knob (Mital, Nicholson &amp; Ayoub, 1993); and ii) pull stay arm under hood (Humanscale, 1981: Tab 4 Human Strength).</p> <p>The following forces <b>exceed</b> ergonomic guidelines: lift hood (Kodak, 1986).</p>
<p><b>3. Operating Control Panel (Elgin Ford #2108)</b></p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> <li>▪ Shoulder abduction 30°</li> <li>▪ Elbow extension 100°</li> </ul>	<p>5 sec – 2 min duration 0-33% of shift</p>	<p>Dynamic (&lt;30 sec.) or Static (&gt;30 sec.)  (varies)</p>	<p>▪ Shoulder abduction 30° and elbow extension 100° to operate control panel.</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>	<p>▪ Shoulder abduction 30° and elbow extension 100° to operate control panel.</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
<p><b>4. Driving Ford (Elgin Ford #2108)</b></p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> <li>▪ Elbow extension 90-180°</li> </ul>	<p>varies 34-66% of shift</p>	<p>Dynamic (&lt;30 sec.) or Static (&gt;30 sec.)  (varies)</p>	<p>▪ When seated on the right side, employee tends to drive mostly with the left hand – left elbow extension 90°-180° (varies)</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>	<p>▪ When seated on the right side, employee tends to drive mostly with the left hand – left elbow extension 90°-180° (varies)</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>



Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p><b>5. Filling water tank using a hydrant (Elgin GMC #2073)</b></p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> <li>▪ Squatting</li> <li>▪ Back flexion 30-50°</li> <li>▪ Shoulder flexion</li> <li>▪ Elbow pronation</li> <li>▪ Elbow extension</li> </ul> <p>Force:</p> <ul style="list-style-type: none"> <li>▪ Lifting assorted tools and parts</li> <li>▪ Loosen cap</li> <li>▪ Tighten / loosen independent gate valve</li> <li>▪ Open / close hydrant</li> <li>▪ Secure / loosen water hose</li> </ul>	<p>15-20 min duration</p> <p>0-33% of shift (once per shift)</p>	<p>Dynamic (&lt;30 sec.)</p> <ul style="list-style-type: none"> <li>▪ squatting, back flexion, elbow pronation, elbow extension, shoulder flexion</li> </ul>	<p style="text-align: center;"><b>Assessment</b></p>	<ul style="list-style-type: none"> <li>▪ Squatting or back flexion to position / remove independent gate valve, cap, and water hose</li> <li>▪ shoulder flexion and elbow extension to secure / remove above parts using hydrant key (+ extension)</li> <li>▪ elbow pronation to open / close hydrant</li> </ul> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B). Able to pause and take mini-breaks as required.</p>
<p style="text-align: center;"><b>Identification</b></p>	<ul style="list-style-type: none"> <li>▪ tools weigh 1.4 – 2.3 kg</li> <li>▪ independent gate valve – 2.7 kg</li> <li>▪ loosen cap – 1.8 kg</li> <li>▪ tighten independent gate valve – 2.7 kg</li> <li>▪ open / close hydrant – &lt;2.3 kg</li> <li>▪ secure water hose – 3.2 kg</li> <li>▪ loosen water hose – 2.7 kg</li> <li>▪ loosen independent gate valve – 2.7 kg</li> </ul>	<ul style="list-style-type: none"> <li>▪ Weight of hydrant key (2.3) + extension (1.4) = 3.7 kg</li> <li>▪ Loosen cap on hydrant (using hydrant key + extension) – push down force 1.8 kg. Note: i) Height varies depending on orientation of teeth on cap; and ii) Forces depend on how tight last worker tightened the cap.</li> <li>▪ Tighten independent gate valve on hydrant (using hydrant key + extension) – pull back force 2.7 kg. Note: Height varies depending on orientation of teeth.</li> <li>▪ Open / close hydrant (using hydrant key + extension) at a height of 89 cm – horizontal push / pull force of less than 2.3 kg.</li> <li>▪ Secure water hose to the independent gate valve (using hydrant key + extension) – horizontal force of 3.2 kg</li> <li>▪ Loosen water hose (using hydrant key + extension) – horizontal pull force of 2.7 kg.</li> <li>▪ Loosen independent gate valve (using hydrant key + extension) – horizontal pull force of 2.7 kg. Note: Height depends on orientation of teeth.</li> </ul> <p>The lifts are within recommended weight limits for lifting tasks (WCB Worksheet B). Forces to loosen cap, tighten / loosen independent gate valve, open / close hydrant, and secure / loosen water hose are within ergonomic guidelines (Kodak, 1986, Mital et al., 1993).</p>			

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>6. Cleaning truck using water hose (Elgin Crosswind)</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> <li>▪ Shoulder flexion 0-70°</li> <li>▪ Elbow pronation</li> <li>▪ Back flexion up to 45°</li> <li>▪ Kneeling</li> </ul>	<p>30-45 min duration</p> <p>0-33% of shift (once per shift)</p>	<p>Dynamic (&lt;30 sec.)</p> <ul style="list-style-type: none"> <li>▪ shoulder flexion, elbow pronation, back flexion, kneeling</li> </ul> <p>Static (&gt;30 sec.)</p> <ul style="list-style-type: none"> <li>▪ power grip hold on hose (with both hands)</li> </ul>	<p>Assessment</p>	<ul style="list-style-type: none"> <li>▪ While holding hose at elbow height, assumes shoulder flexion (up to 70°) + elbow pronation to maneuver hose</li> <li>▪ Back flexion to wash off areas at bottom or underneath sweeper</li> <li>▪ Kneeling to hose underneath sweeper – kneels on hose (to prevent contact stress on knees)</li> </ul> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B). Able to pause and take mini-breaks as required.</p>
	<p>Force:</p> <ul style="list-style-type: none"> <li>▪ Wt. of hose</li> </ul>	<p>30-45 min duration</p> <p>0-33% of shift (once per shift)</p>	<ul style="list-style-type: none"> <li>▪ 2.5 kg wt of hose</li> </ul>		<ul style="list-style-type: none"> <li>▪ Support weight of hose – 2.5 kg (without water). Note: Forces while spraying (i.e. with water spraying) could not be measured since a horizontal force is applied forward to prevent the hose from going backwards. Horizontal force is dependant on water output pressure.</li> </ul> <p>Force to support weight of hose is acceptable – worker has control over water output pressure and, consequently, the forces required to support the hose.</p>

**SUMMARY**

The risk identification and assessment for some of the Sweeper Operator's job tasks have identified some risk factors that exceed recommended guidelines. While these tasks have been assessed individually, cumulative effects of combined tasks may increase the level of risk.

In general the risk factors for the Sweeper Operator are related to exerting high forces (using back and shoulder muscles).

New crew members who have not acclimatized to the physical demands of work may be at an increased risk of injury. All crew members are at a higher risk of injury in the morning hours when they may not be physically prepared or warmed up prior to performing physically demanding work. This was demonstrated in the Corporation of Delta's musculoskeletal injury (MSI) analyses (2001) report where 55% of MSI WCB claims occurred in the AM.

Additionally, while not exceeding guidelines for the individual tasks, cumulative effects of awkward postures of the neck, back, shoulder and arm/wrist may increase the risk of injury (> 66% of shift when all activities or tasks are combined).

Recommendations for control of identified risk factors will focus on methods to minimize risk.

*\*Control Priority Note: 1 = recommended for implementation to reduce risk factors; 2 = optional, for consideration as a means of reducing risk factors; 3 = not for immediate action but for future consideration as appropriate.*

<b>Risk Factor</b>	<b>Recommended Controls</b>	<b>Control Priority*</b>	<b>Responsible Person</b>	<b>Status</b>
Endurance for physically demanding work	Maintain an increased level of fitness focusing on cardiovascular and muscular endurance and muscular flexibility. This is especially important for new workers who may not be acclimatized to the demands of work.	2	Employee	
Preparation for all physically demanding work	Develop a physical warm up program and train workers specific to the demands of the job. Workers should perform this warm up prior to the start of the day and before resuming work following >30 min. breaks. The duration of the warm up is less than 10 min. Micro stretches should also be performed following static, awkward postures e.g. neck and back bending.	2	Superintendent / Safety Dept.	
Force: Tools and equipment	Ensure all tools and equipment are in good shape and repair. Static forces will increase if tools and equipment require more work or repetition of work due to poor maintenance including cleaning.  Evaluate tools and equipment when being replaced to ensure the weight and design (e.g. grip) will reduce the workload (e.g. wrenches, valve key etc.).  Continue to encourage employees to use extension on hydrant key when filling water tank using a hydrant.	1  3  1	Superintendent Employee  Superintendent Employee  Superintendent Employee	
Operating parking brake (push) while seated on the RIGHT side	Pushing (releasing) the parking brake while seated on the RIGHT side exceeds ergonomic guidelines. It is, therefore, recommended that when pushing / releasing the parking brake, the operator should sit up or rise slightly from the seat so that the left elbow is completely extended while applying the push force. As a result, the operator will use much of their upper body strength to push the parking brake bringing the force application closer to acceptable limits (Humanscale, Tab 4: Human Strength, weak males).	1	Superintendent Employee	

Risk Factor	Recommended Controls	Control Priority*	Responsible Person	Status
Lifting and lowering hood	<p>Investigate feasibility of 2-person lifting and lowering of the hood until forces are reduced.</p> <p>Determine how high the hood <u>must</u> be raised for the pre-trip inspection. If required pre-trip inspections can be done while the hood is at a lower height, then the hood should only be raised until this height. Re-measure forces to lift and lower the hood to this height to determine if within guidelines.</p> <p>Investigate reducing the forces required to lift and lower the hood, i.e. mechanically.</p>	<p>1</p> <p>1</p> <p>1</p>	<p>Superintendent Employee</p> <p>Superintendent</p> <p>Superintendent</p>	
Awkward postures	<p>Encourage employees to alternate hands while driving, i.e. avoid using only one hand. This will provide an opportunity for recovery / rest breaks.</p> <p>Encourage employees to place arms close to the body whenever possible (for e.g. avoid resting arm on the control panel when not using it).</p> <p>For future Sweeper purchases, consider steering wheel with adjustable tilt and reach.</p>	<p>1</p> <p>1</p> <p>2</p>	<p>Superintendent Employee</p> <p>Superintendent Employee</p> <p>Superintendent</p>	
Overall risk factors	<p>Provide education related to identified risk factors and methods of working to reduce risk e.g. neutral joint positions, leg position, reduction of twisting, avoiding contact stress etc.</p>	1	Superintendent	

**References:**

- WCB of BC, Worksheet A, Risk Identification and Worksheet B, Risk Assessment.
- Eastman Kodak (1986), Ergonomic Design for People at Work, Volume 1
- Putz-Anderson (1988), Cumulative Trauma Disorders: A manual for musculoskeletal diseases of the upper limbs
- Mital, Nicholson & Ayoub (1993), A Guide to Manual Material Handling
- Humanscale (1981) – Tab 4: Human Strength

Prepared by: Farzana Ismail, November 1, 2003