

## CASE STUDY - Hose Handling

### TASK TITLE: Hose Handling - Aircraft Refueling

<b>Task Description:</b>	<p>Hose handling activities in this example describe the process used to refuel a fighter aircraft. The fuel is delivered to the aircraft by a fuel truck. The individual pulls the fuel hose from the truck, carries/draws the hose to the aircraft, and raises and secures the hose fitting to the aircraft. After refueling, the hose is removed from the aircraft. The spool on which the hose is carried on the truck is used to re-wind the hose.</p> <p>Typical jobs in which hose handling is involved include:</p> <ul style="list-style-type: none"><li>• aircraft refueling</li><li>• fire fighting</li><li>• liquid fuels maintenance/attaching and detaching hoses.</li></ul> <p>This case study addresses potential ergonomics issues associated with a moving and handling low pressure hoses.</p>
<b>Job Performance Measures Most Often Impacted by Hose Handling:</b>	<ul style="list-style-type: none"><li>• Avoidance of spills.</li><li>• Speed of task completion.</li></ul>
<b>Typical Employee Comments about Hose Handling:</b>	<p>Employees typically identify discomfort in the shoulder and back from dragging the hose and lifting it to the refueling locations. In some cases, there may be a concern for the hands and fingers due to the difficulty in and detaching hoses and clamps.</p> <p>Primary concerns: back/torso, shoulder/neck Secondary concerns: hands/wrists/arms.</p>
<b>Suggested Level II Analysis:</b>	Dynamic Task Analysis, Grip Force Measurement, Push/Pull Measurement

## Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Reaching	<ul style="list-style-type: none"> <li>Refueling point is too high</li> <li>Inappropriate technique used to drag hose</li> </ul>	123. Raise the person <ul style="list-style-type: none"> <li>use a step stool or ladder</li> </ul>	✓	✓	med	med	med
		13. Encourage ergonomic work techniques <ul style="list-style-type: none"> <li>face the direction of travel when moving hoses</li> <li>hold hose close to the body at waist level or over the shoulder</li> </ul>	✓		low	med	med
			✓		low	med	med
2. Arm forces: Repeated contraction of the muscles of the arm or holding/ carrying materials	<ul style="list-style-type: none"> <li>Weight of hose, distance traveled, and friction between the hose and the ground</li> </ul>	126. Reduce carry distance <ul style="list-style-type: none"> <li>locate the fuel / truck as close to the air craft as possible.</li> </ul>	✓		low	low	med
		13. Encourage ergonomic work techniques <ul style="list-style-type: none"> <li>unwind the fuel hose (at least partially) prior to dragging the hose to the aircraft; avoid simultaneous pulling and unwinding of the hose from the truck.</li> </ul>	✓		low	med	med

**Shoulder/Neck (cont'd)**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Wear or damage to hose clamp or material build-up can make clamp difficult to seal and remove. (see Figure 1.1)</li> </ul>  <p style="text-align: center;"><b>Figure 1.1</b></p>	<p>35. Maintain tracks, rollers, or movement mechanisms</p> <ul style="list-style-type: none"> <li>regularly clean and repair hose connectors/clamps</li> <li>replace damaged clamps</li> <li>replace worn hoses with hoses that are enclosed in a low friction casing - facilitates sliding</li> </ul>	✓	<ul style="list-style-type: none"> <li>✓</li> <li>✓</li> </ul>	<p>low</p> <p>med high</p>	<p>med</p> <p>med med</p>	<p>med</p> <p>med high</p>

## Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
3. High speed, sudden shoulder movements	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
4. Head/neck bent or twisted	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
5. Bent wrists/repeated wrist movements or repeated forearm rotation	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
6. Repeated manipulations with fingers	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
7. Hyperextension of finger/thumb or repeated single finger activation	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					

## Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Hand/grip forces	<ul style="list-style-type: none"> <li>Weight of hose, distance traveled, and friction between the hose and the ground</li> <li>Wear or damage to hose clamp or material build-up can make clamp difficult to seal or remove</li> </ul>	126. Reduce carry distance <ul style="list-style-type: none"> <li>locate the truck as close to the aircraft as possible.</li> </ul>	✓		low	low	med
		13. Encourage ergonomic work techniques <ul style="list-style-type: none"> <li>unwind the fuel hose (at least partially) prior to dragging the hose to the aircraft; avoid simultaneous pulling and unwinding of the hose from the truck.</li> </ul>	✓		low	low	med
		75. Provide a tool which can be used by both hands <ul style="list-style-type: none"> <li>use a hook (handle sized for both hands) to drag the hose instead of gripping the hose itself.</li> </ul>	✓		med	low	med
		35. Maintain tracks, rollers, or movement mechanisms <ul style="list-style-type: none"> <li>regularly clean and repair hose connectors/clamps</li> <li>replace damaged clamps</li> </ul>	✓	✓	low med	med med	med med

**Hands/Wrists/Arms (cont'd)**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. High speed hand/wrist/arm movements or vibration, impact or torque to the hand	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
10. Exposure to hard edges	<ul style="list-style-type: none"> <li>Rarely occurs.</li> </ul>	N/A					
11. Hands and fingers exposed to cold temperatures	<ul style="list-style-type: none"> <li>Work area is too cold</li> </ul>	93. Provide appropriate gloves	✓	✓	med	med	med

## Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
12. Repeated forward or sideways bending movements	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
13. Twisting of the lower back	<ul style="list-style-type: none"> <li>Inappropriate work technique while moving hose</li> </ul>	13. Encourage ergonomic work techniques <ul style="list-style-type: none"> <li>face the direction of travel when moving hoses</li> <li>hold hose close to the body at waist level or over the shoulder</li> </ul>	✓  ✓		low low	low low	med med
14. High speed, sudden movements	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
15. Static, awkward back postures	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					

**Back/Torso (cont'd)**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Lifting forces	<ul style="list-style-type: none"> <li>Hose is heavy</li> <li>Lifting hose from ground level increases force in the low back</li> </ul>	13. Encourage ergonomic work techniques <ul style="list-style-type: none"> <li>place hose over the shoulder immediately upon removal from truck - never let hose reach the end of the hose reach the ground.</li> </ul>	✓		low	low	med
17. Pushing or pulling	<ul style="list-style-type: none"> <li>Weight of hose, distance traveled, and friction between the hose and the ground</li> </ul>	126. Reduce carrying distance <ul style="list-style-type: none"> <li>locate the fuel truck as close to the aircraft as possible.</li> </ul> 35. Mountain tracks, rollers, or movement mechanism. <ul style="list-style-type: none"> <li>replace worn hoses with hoses that are enclosed in a low friction casing - facilitating sliding.</li> </ul>	✓	✓	low  high	low  med	med  high
18. Whole body vibration	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					

**Legs/Feet**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Fixed position, standing	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
20. Exposure to hard edges on legs, knees, and feet	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
21. Awkward leg postures	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
22. Standing foot pedal	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
23. Difficult to see/light levels too low/too high	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
24. Intensive visual tasks, staring at work objects for long periods	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					