NPSafe

Safe Acts & Attitudes Foster Excellence

The Perfect Fit: People, Equipment and Processes

An Ergonomics Program Implementation Workshop

Participant Guide

Prepared by
NPS Risk Management Division

Revised February 1, 2006

How to Interact with the Instructor

We encourage you to ask questions and share your comments with the instructors throughout this TELNPS course.

If you were physically in the classroom with the instructor, you would raise your hand to let him know you had a question or comment. Then you would wait for the instructor to recognize you and ask for your question. We are all familiar with that "protocol" for asking questions or making comments.

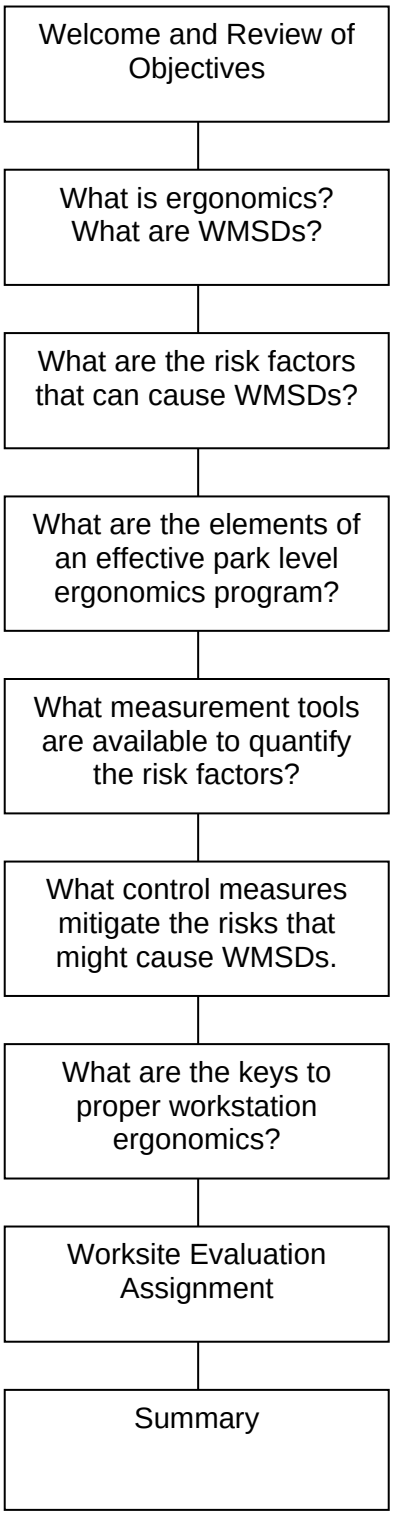
With TELNPS courses there is also a "protocol" to follow to ensure you can easily ask questions and others can participate as well. It may seem a little strange at first asking a question of a TV monitor. Remember, it is the instructor you are interacting with and not the monitor. As you ask more questions and participate in more TELNPS courses, you will soon be focusing only on the content of your question and not the equipment you are using to ask it.

As part of the TEL station equipment at your location, there are several push to talk microphones. Depending on the number of students at your location, you may have one directly in front of you or you may be sharing one with other students at your table.

When you have a question, press the push to talk button and say,
"Excuse me [instructor's first name], this is [your first name]
at [your location]. I have a question (or I have a comment)."
Then release the push to talk button. This is important.
Until you release the button, you will not be able to hear the instructor.

The instructor will acknowledge you and then ask for your question or comment. Stating your name and location not only helps the instructor, but also helps other students who are participating at different locations to get to know their classmates.

The Perfect Fit: People, Equipment and Processes



Course Objectives

Notes

At the end of this workshop, you should be able to:

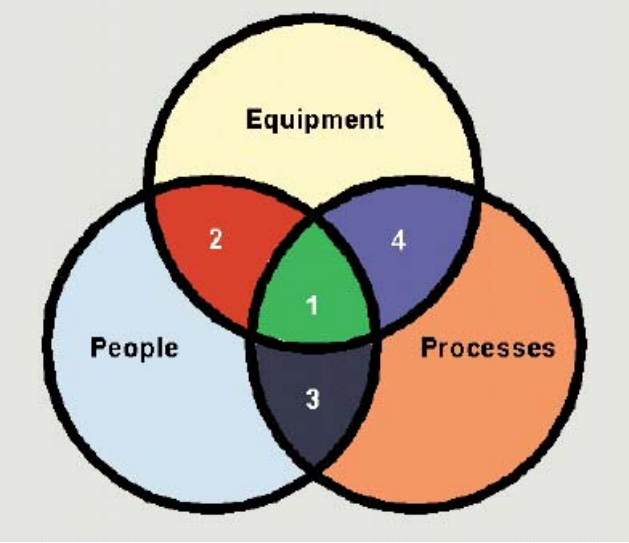
1. Recognize common workplace musculoskeletal disorders (WMSD)
2. Recognize major risk factors that can contribute to WMSDs
3. Recognize some measurement tools that can be used to quantify risk factors of WMSDs
4. Describe the elements of a park ergonomics program for the reduction of WMSDs
5. Conduct a rudimentary evaluation of worksite processes to identify WMSD risks

What is Ergonomics?

Notes

"Ergon" = Work

"Nomus" = Natural law



What Are WMSDs?

Notes

Common Terms:

Work Related Muscular Skeletal Disorder (WMSD)

Cumulative Trauma Disorder (CTD)

Repetitive Motion Injury (RMI)

Repeated biomechanical stress and micro-trauma cause or aggravate WMSDs.

Over time, repeated micro-trauma can evolve into a painful, debilitating state involving muscles, tendons, tendon sheaths, and nerves.

Top Ten Occupations for WMSDs	
• RN's • Nurse's aides, orderlies, and attendants • Truck drivers • Laborers not involved in construction • Assemblers	• Janitors and cleaners • Stock handlers and baggers • Construction laborers • Cashiers • Carpenters

WMSD Symptoms	
• Numbness • Burning • Pain	• Tingling • Cramping • Stiffness

WMSDs
• Muscle strains and tears • Ligament and joint sprains • Joint and tendon inflammation • Pinched nerves (nerve compression • Spinal disc degeneration

What Are The Risk Factors That Can Cause WMSDs?

Notes

- Repetitive Motions (prolonged activities)
- Awkward posture (sustained)
- Excessive bending or twisting (wrists)
- Overhead work (shoulder and elbow)
- Forceful exertions (awkward positions)
- Excessive use of small muscle groups (pinch)
- Acceleration and velocity (dynamic motions)
- Vibration
- Mechanical compression
- Restrictive workstations (inadequate clearances)
- Improper seating or support
- Inappropriate hand tools
- Pacing (production–based incentives)
- Extreme temperatures
- Hazardous or annoying noise

Force

Repetition

Duration

Inadequate Rest or Recovery

What Are the Elements of an Effective Park Level Ergonomics Program?

Notes

Worksite analysis for risk factors

Prevention and Control

Healthcare management

Training and Participation

Worksite Analysis for Work Factors

- OSHA logs
- Job Hazard Analysis

- Analyze jobs
- Seek employee input
- Assess common problems in your industry

Worksite Analysis for Work Factors (continued)

NIOSH Lifting Equation

Max Safe Load = 51 lbs Modified by Risk Factors Recommended Load

RWL = LC x HM x VM x DM x AM x FM x CM

HM = Horizontal Multiplier HM = 10/*H*

H = Horizontal location of hands from midpoint between the ankles. Measure at the origin and the destination of the lift. Limits are 10 inches (any closer and interference from lifting due to abdomen or hyperextension of shoulders) & 25 inches (any farther and loss of balance results).

If *H* < 10 in (25 cm), then *HM* = 1.0 If *H* > 25 in (63 cm), then *HM* = 0

VM = Vertical Multiplier VM = 1 – (0.0075 x | *V* – 30|)

V = Vertical location of the hands from the floor. Measure at the origin and destination of the lift (cm or in). The limits for the vertical distance are 0 (object grasped at the floor) to 70 inches (175 cm) which is the upper limit of vertical reach for lifting.

If *V* = 0, VM = 0.78 If *V* > 70 in (175 cm), then *VM* = 0

DM = Distance Multiplier DM = 0.82 + (1.8 / *D*)

D = Vertical travel distance between the origin and the destination of the lift (cm or in). *D* = *Vo* – *Vf*. The limits for the vertical travel distance are the same as those for the vertical distance, 0 to 70 inches.

If *D* < 10 in (25 cm), then *DM* = 1.0 If *D* > 70 in (175 cm), then *DM* = 0

AM = Axis Multiplier AM = 1 – (0.0032 x A)

A = Angle of asymmetry — angular displacement of the load from the sagittal plane. Measured at the origin unless significant control of load is required at destination of the lift (degrees). The limits are 0° and 135°.

If *A* = 0°, then *AM* = 1.0 If *A* > 135°, then *AM* = 0

FM = Frequency Multiplier

Lifts per minute (15 minute average) Lift duration and recovery
Frequency Multiplier Table (See next page)

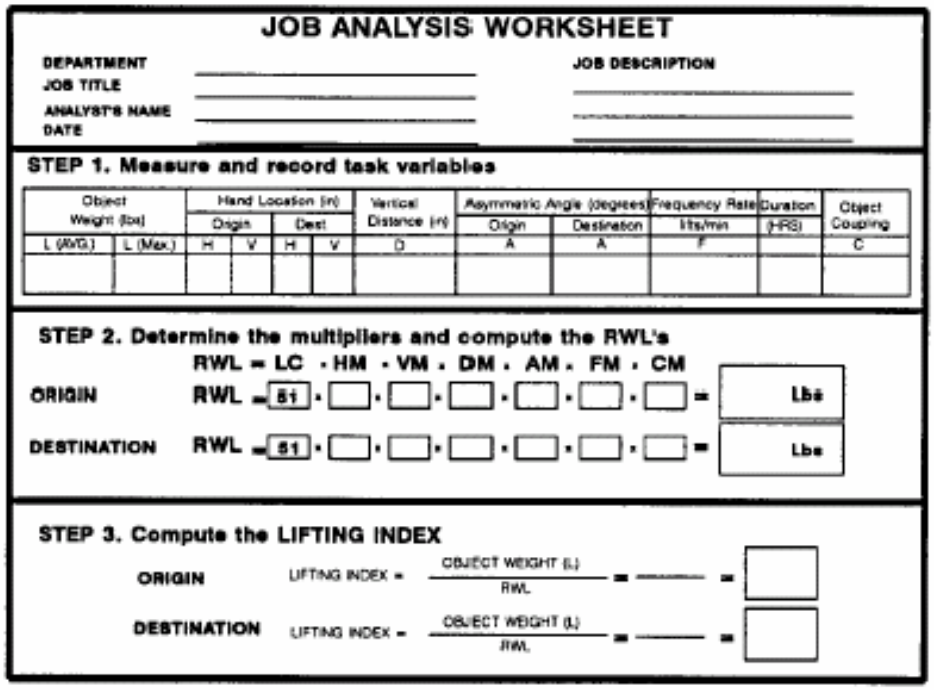
Coupling Quality	CM = Coupling Multiplier	
	V < 30 inches	V ≥ 30 inches
Good	1.0	1.0
Fair	0.95	1.0
Poor	0.90	0.90

Worksite Analysis for Work Factors (continued)

Notes

Frequency Multiplier Table

F lifts/min	DURATION < 1 hour		1 – 2 hours		2 – 8 hours	
	V < 30	V ≥ 30	V < 30	V ≥ 30	V < 30	V ≥ 30
≤ 0.2	1.0	1.0	.95	.95	.85	.85
0.5	.97	.97	.92	.92	.81	.81
1	.94	.94	.88	.88	.75	.75
2	.91	.91	.84	.84	.65	.65
3	.88	.88	.79	.79	.55	.55
4	.84	.84	.72	.72	.45	.45
5	.80	.80	.60	.60	.35	.35
6	.75	.75	.50	.50	.27	.27
7	.70	.70	.42	.42	.22	.22
8	.60	.60	.35	.35	.18	.18
9	.52	.52	.30	.30	0	.15
10	.45	.45	.26	.26	0	.13
11	.41	.41	0	.23	0	0
12	.37	.37	0	.21	0	0
13	0	.34	0	0	0	0
14	0	.31	0	0	0	0
15	0	.28	0	0	0	0
> 15	0	0	0	0	0	0



JOB ANALYSIS WORKSHEET

DEPARTMENT
JOB TITLE
ANALYST'S NAME
DATE

JOB DESCRIPTION

STEP 1. Measure and record task variables

Object Weight (lbs)		Hand Location (in)				Vertical Distance (in)	Asymmetric Angle (degrees)		Frequency Rate	Duration	Object Coupling
		Origin		Dest			Origin	Destination	lifts/min	(HRS)	
L (AVG.)	L (Max.)	H	V	H	V	D	A	A	F		C

STEP 2. Determine the multipliers and compute the RWL's

RWL = LC · HM · VM · DM · AM · FM · CM

ORIGIN RWL = 51 · ___ · ___ · ___ · ___ · ___ · ___ = ___ Lbs

DESTINATION RWL = 51 · ___ · ___ · ___ · ___ · ___ · ___ = ___ Lbs

STEP 3. Compute the LIFTING INDEX

ORIGIN LIFTING INDEX = OBJECT WEIGHT (L) / RWL = ___ = ___

DESTINATION LIFTING INDEX = OBJECT WEIGHT (L) / RWL = ___ = ___

Figure 3: Single Task Job Analysis Worksheet

Worksite Analysis for Work Factors (continued)

Notes

If HM < 1

- bring the load closer to the body
- remove horizontal barriers
- reduce the size of the load

If VM < 1

- raise or lower the origin or destination of the lift
- avoid lifting at the floor or above the shoulders

If DM < 1

- reduce the vertical distance between the origin and destination

If AM < 1

- move origin and destination closer to reduce the angle of twist
- move the origin and destination farther apart to force the worker to turn and step rather than twist

If FM < 1

- reduce the lifting frequency
- reduce the duration of lifting
- provide longer rest periods

If CM < 1

- provide containers with handles
- improve existing grip points on lifted objects

Lifting Index = Load Weight / RWL

LI < 1, then no risk of low back pain/injury for most workers
LI > 1, increasing risk for susceptible workers
LI > 3, risk for nearly all workers

Prevention and Control

- Process Elimination
- Engineering Controls
- Substitution
- Work Practices
  - Techniques
  - Personal conditioning
  - Monitoring

Engineering Controls

- Workstations
- Tools
- Facilities
- Equipment
- Materials
- Processes

Work Station Design

- To accommodate different people
- Permit several working positions
- Easy reach
- Locations of controls and tools
- Remove barriers

Tool Design

- Handle length
- Minimization of muscular effort
- Motors rather than muscles
- Bend the tool not the wrist
- Left handed?
- Size and shape of grip
- Spring loading pliers, scissors
- Large triggers

Administrative Controls

- Resequence Jobs
- Employee Rotation
- Job Enlargement
- Adjust Work Pace
  - Redesign work methods
  - Alternative tasks
  - Rest breaks
  - Self-pacing

Personal Protective Equipment (PPE)

- Interim control devices
- Vibration dampening gloves
- Wrist braces
- Back belts?

What Are the Keys to Proper Workstation Ergonomics?

Workstation Problems

- VDT Screens – lighting & vision considerations
- Faster key stroking for longer durations
- Fewer alternate activities or postures
- Worker concern about heat, electrostatic and electromagnetic fields
- Psychological stress (technology, job conditions)

These workstation problems result in:

- Cumulative Trauma Disorders (CTDs)
- Other Ergonomic Problems.

- Increase in Reported Incidents
- Upper Extremity & Back Pain
- Eye Strain

Risk Factors Specific to Office Workstatons:

- Repetition
- Sustained static exertions
- Forceful exertions
- Localized contact stresses
- Posture

Sustained Static Exertions

- Prolonged gripping of a computer mouse
- Prolonged sitting
- Holding the hands still above the keyboard during typing pauses
- Prolonged holding of a phone handset against the ear
- Hunching or elevating the shoulders while keying

Posture

- Bending wrists upward or downward during keying
- Bending wrist sideways reaching for side keys
- Extending arm to teach a mouse
- Raising shoulders to compensate for high keyboard or to hold a phone to the ear

What Are the Keys to Proper Workstation Ergonomics? (continued)

Notes

Back Risks: Sitting

- Lower back flattens in sitting position
- Puts extra weight on the backs of legs and buttocks.
- Reduced muscle tone, especially abdomen
- Chairs too large or small provide poor body support

Sitting Behaviors

- Sitting for long periods
- Using non-neutral neck postures for long periods
- Large or asymmetrical load on back
- Repeated bending, lifting, or twisting of the torso
- Sitting for long periods without using the chair backrest

Eye Strain

- Glare
- Luminance
- Lighting Levels
- Viewing Distance
- Monitor or Document Height
- Readability of Screen
- Vision Correction

Physical Agents

- Heat
- Electrostatic fields
- Electromagnetic radiation

What Are the Keys to Proper Workstation Ergonomics? (continued)

Notes

Controls for CTD Risks
- Repetition
- Sustained Static Exertions
- Forceful Exertions
- Localized Contact Stresses
- Posture

Controls for Posture Risks
- Posture changes
- Seating

Controls for Eyestrain Risks
- Luminance Ration between Screen and Environment
- Lighting Levels
- Viewing Distance/Monitor or Document Height
- Readability
- Vision Correction

Training and Participation

Notes

Employee Training

- Potential risks and possible causes of WMSDs
- How to recognize and report symptoms
- How to prevent WMSDs
- Sources of treatment
- Demonstration of the proper use and care of all tools and equipment
- Correct use of safety equipment (PPE)
- Safe and proper work procedures, such as proper lifting techniques

For Additional Information

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OSHA Ergonomic E-Tools
http://www.osha.gov/SLTC/etools

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1. Using the checklist at Appendix ___ Complete an evaluation of a task that an employee at your workplace does from an ergonomics perspective.

2. Identify the risk factors that may contribute to WMSDs.

3. Identify what control measures are currently in use to mitigate those risk factors.

4. Identify what additional control measures might further mitigate or eliminate the risks and a date by which they will be implemented.

5. Send your written report of Steps 2-4 to: david_p_bleicher@partner.nps.gov by February 9, 2006.

List of Common Cumulative Trauma Disorders of the Upper Extremities

Table 28.2 — List of Common Cumulative Trauma Disorders of the Upper Extremities
(Adapted from **Kroemer, K.H.E.**: Ergonomics, (Chapter 13). *Fundamentals of Industrial Hygiene*, 4th Ed. 1996. p. 396-397).

Disorder	*Description*	*Typical Job Activities*
Carpal tunnel syndrome (writer's cramp, neuritis, median neuritis)(N)	The result of compression of the median nerve in the carpal tunnel of the wrist. This tunnel is an opening under the carpal ligament on the palmar side of the carpal bones. Through this tunnel pass the median nerve, the finger flexor tendons, and blood vessels. Swelling of the tendon sheaths reduces the size of the opening of the tunnel and pinches the median nerve and possibly blood vessels. The tunnel opening is also reduced if the wrist is flexed or extended or ulnarly or radially pivoted.	Buffing, grinding, polishing, sanding, assembly work, typing, keying, cashiering, playing musical instruments, surgery, packing, housekeeping, cooking, butchering, hand washing, scrubbing, hammering.
Cubital tunnel syndrome (N)	Compression of the ulnar nerve below the notch of the elbow. Tingling, numbness, or pain radiating into ring or little fingers.	Resting forearm near elbow on a hard surface or sharp edge or reaching over obstruction.
deQuervain's syndrome (or disease) (T)	A special case of tendo synovitis that occurs in the abductor and extensor tendons of the thumb where they share a common sheath. This condition often results from combined forceful gripping and hand twisting, as in wringing cloths.	Buffing, grinding, polishing, sanding, pushing, pressing, sawing, cutting, surgery, butchering, use of pliers, "turning" control such as on motorcycle, inserting screws in holes, forceful hand wringing.
Epicondylitis ("tennis elbow") (T)	Tendons attaching to the epicondyle (the lateral protrusion at the distal end of the humerus bone) become irritated. This condition is often the result of impacting or jerky throwing motions, repeated supination and pronation of the forearm, and forceful wrist extension movements. The condition is well-known among tennis players, pitchers, bowlers, and people hammering. A similar irritation of the tendon attachments on the inside of the elbow is called medical epicondylitis, also known as "golfer's elbow."	Turning screws, small parts assembly, hammering, meat cutting, playing musical instruments, playing tennis, pitching, bowling.
Ganglion (T)	A tendon sheath swelling that is filled with synovial fluid, or cystic tumor at the tendon sheath or a joint membrane. The affected area swells up and causes a bump under the skin, often on the dorsal or radial side of the wrist. (Because it was in the past occasionally smashed by striking with a bible or heavy book, it was also called a "bible bump.")	Buffing, grinding, polishing, sanding, pushing, pressing, sawing, cutting, surgery, butchering, use of pliers, "turning" control such as on motorcycle, inserting screws in holes, forceful hand wringing.
Neck tension syndrome (M)	An irritation of the levator scapulae and trapezius group of muscles of the neck, commonly occurring after repeated or sustained overhead work.	Belt conveyor assembly, typing, keying, small parts assembly, packing, load carrying in hand or on shoulder.
Pronator (teres) syndrome (N)	Result of compression of the median nerve in the distal third of the forearm, often where it passes through the two heads of the pronator teres muscle in the forearm; common with strenuous flexion of elbow and wrist.	Soldering, buffing, grinding, polishing, sanding.
Shoulder tendinitis (rotator cuff syndrome or tendinitis, supraspinatus tendinitis, subacromial bursitis, subdeltoid bursitis, partial tear of the rotator cuff) (T)	This is a shoulder disorder located at the rotator cuff. The cuff consists of four tendons that fuse over the shoulder joint, where they pronate and supinate the arm and help to abduct it. The rotator cuff tendons must pass through a small bony passage between the humerus and the acromion, with a bursa as cushion. Irritation and swelling of the tendon or of the bursa are often caused by continuous muscle and tendon effort to keep the arm elevated.	Punch press operations, overhead assembly, overhead welding, overhead painting, overhead auto repair, belt conveyor assembly work, packing, storing, construction work, postal letter carrying, reaching, lifting, carrying load on shoulder.

List of Common Cumulative Trauma Disorders of the Upper Extremities

Table 28.2 — List of Common Cumulative Trauma Disorders of the Upper Extremities (continued)

Disorder	*Description*	*Typical Job Activities*
Tendinitis (tendinitis) (T)	An inflammation of a tendon. Often associated with repeated tension, motion, bending, being in contact with a hard surface, vibration. The tendon becomes thickened, bumpy, and irregular in its surface. Tendon fibers may be frayed or torn apart. In tendons without sheaths, such as within elbow and shoulder, the injured area may calcify.	Punch press operation, assembly work, wiring, packaging, core making, use of pliers.
Tendo synovitis (tenosynovitis, tendovaginitis) (T)	This disorder occurs to tendons inside synovial sheaths. The sheath swells. Consequently, movement of the tendon with the sheath is impeded and painful. The tendon surfaces can become irritated, rough, and bumpy. If the inflamed sheath presses progressively onto the tendon, the condition is called stenosing tendo synovitis. DeQuervain's syndrome is a special case occurring in the thumb, while the trigger finger condition occurs in flexors of the fingers.	Buffing, grinding, polishing, sanding, punch press operation, sawing, cutting, surgery, butchering, use of plier, "turning' control such as on a motor cycle, inserting screws in holes, forceful hand wringing.
Thoracic outlet syndrome (neurovascular compression syndrome, cervicobrachial disorder, brachial plexus neuritis, costoclavicular syndrome, hyperabduction syndrome) (V,N)	A disorder resulting from compression of nerves and blood vessels between clavicle and first and second ribs at the brachial plexus. If this neurovascular bundle is compressed by the pectoralis minor muscle, blood flow to and from the arm is reduced. This ischemic condition makes the arm numb and limits muscular activities.	Buffing, grinding, polishing, sanding, overhead assembly, overhead welding, overhead painting, overhead auto repair, typing, keying, cashiering, wiring, playing musical instruments, surgery, truck driving stacking, material handling, postal letter carrying, carrying heavy loads with extended arms.
Trigger finger (or thumb) (T)	A special case of tendo synovitis where the tendon becomes nearly locked so that its forced movement is not smooth but snaps or jerks. This is a special case of stenosing tendo synovitis crepitans, a condition usually found with digit flexors at the A1 ligament.	Operating finger trigger, using hand tools that have sharp edges pressing into the tissue or whose handles are too far apart for the user's hand so that the end segments of the fingers are flexed while the middle segments are straight.
Ulnar artery aneurysm (V,N)	Weakening of a section of the wall of the ulnar artery as it passes through the Guyon tunnel in the wrist; often from pounding or pushing with heel of the hand. The resulting "bubble" presses of the ulnar nerve in the Guyon tunnel.	Assembly work.
Ulnar nerve entrapment (Guyon tunnel syndrome) (N)	Results from the entrapment of the ulnar nerve as it passes through the Guyon tunnel in the wrist. It can occur from prolonged flexion and extension of the wrist and repeated pressure on the hypothenar eminence of the palm.	Playing musical instruments, carpentering, brick laying, use of pliers, soldering, hammering.
White finger ("dead finger," Raynaud's syndrome, vibration syndrome) (V)	Stems from insufficient blood supply bringing about noticeable blanching. Finger turns cold, numb, tingles, and sensation and control of finger movement may be lost. The condition is due to closure of the digit's arteries caused by vasospasm triggered by vibrations. A common cause is continued forceful gripping of vibrating tools, particularly in a cold environment.	Chain sawing, jack hammering, use of vibrating tool that is too small for the hand, often in a cold environment.

N=nerve disorder; T= tendon disorder; M=muscle disorder; V= vessel disorder.

Source: AIHA. The Occupational Environment—Its Evaluation and Control

Evaluation Checklist

WORKING POSTURES–The workstation is designed or arranged for doing computer tasks so it allows your	**Y**	**N**
1. Head and **neck** to be upright, or in-line with the torso (not bent down/back). If "no" refer to Monitors, Chairs and Work Surfaces.		
2. Head, neck, and **trunk to** face forward (not twisted). If "no" refer to Monitors or Chairs.		
3. Trunk to be perpendicular to floor (may lean back into backrest but not forward). If "no" refer to Chairs or Monitors.		
4. Shoulders and **upper arms** to be in-line with the torso, generally about perpendicular to the floor and relaxed (not elevated or stretched forward). If "no" refer to Chairs.		
5. Upper arms and **elbows** to be close to the body (not extended outward). If "no" refer to Chairs, Work Surfaces, Keyboards, and Pointers.		
6. Forearms, wrists, and **hands** to be straight and in-line (forearm at about 90 degrees to the upper arm). If "no" refer to Chairs, Keyboards, Pointers.		
7. Wrists and **hands** to be straight (not bent up/down or sideways toward the little finger). If "no" refer to Keyboards, or Pointers		
8. Thighs to be parallel to the floor and the **lower legs** to be perpendicular to floor (thighs may be slightly elevated above knees). If "no" refer to Chairs or Work Surfaces.		
9. Feet rest flat on the floor or are supported by a stable footrest. If "no" refer to Chairs, Work Surfaces.		

Notes:

SEATING–Consider these points when evaluating the chair:	**Y**	**N**
10. Backrest provides support for your lower back (lumbar area).		
11. Seat width and **depth** accommodate the specific user (seat pan not too big/small).		
12. Seat front does not press against the back of your knees and lower legs (seat pan not too long).		
13. Seat has cushioning and is rounded with a "waterfall" front (no sharp edge).		
14. Armrests, if used, support both forearms while you perform computer tasks and they do not interfere with movement.		
"No" answers to any of these questions should prompt a review of Chairs.		

Notes:

KEYBOARD/INPUT DEVICE–Consider these points when evaluating the keyboard or pointing device. The keyboard/input device is designed or arranged for doing computer tasks so the	**Y**	**N**
15. Keyboard/input device platform(s) is stable and large enough to hold a keyboard and an input device.		
16. Input device (mouse or trackball) is located right next to your keyboard so it can be operated without reaching.		
17. Input device is easy to activate and the shape/size fits your hand (not too big/small).		
18. Wrists and **hands** do not rest on sharp or hard edges.		
"No" answers to any of these questions should prompt a review of Keyboards, Pointers, or Wrist Rests.		

Notes:

MONITOR–Consider these points when evaluating the monitor. The monitor is designed or arranged for computer tasks so the	**Y**	**N**
19. Top of the screen is at or below eye level so you can read it without bending your head or neck down/back.		
20. User with bifocals/trifocals can read the screen without bending the head or neck backward.		
21. Monitor distance allows you to read the screen without leaning your head, neck or trunk forward/backward.		
22. Monitor position is directly in front of you so you don't have to twist your head or neck.		
23. Glare (for example, from windows, lights) is not reflected on your screen which can cause you to assume an awkward posture to clearly see information on your screen.		
"No" answers to any of these questions should prompt a review of Monitors or Workstation Environment.		

Notes:

WORK AREA–Consider these points when evaluating the desk and workstation. The work area is designed or arranged for doing computer tasks so the	**Y**	**N**
24. Thighs have sufficient clearance space between the top of the thighs and your computer table/keyboard platform (thighs are not trapped).		
25. Legs and **feet** have sufficient clearance space under the work surface so you are able to get close enough to the keyboard/input device.		

Notes:

ACCESSORIES–Check to see if the	Y	N
26. Document holder, if provided, is stable and large enough to hold documents.		
27. Document holder, if provided, is placed at about the same height and distance as the monitor screen so there is little head movement, or need to re-focus, when you look from the document to the screen.		
28. Wrist/palm rest, if provided, is padded and free of sharp or square edges that push on your wrists.		
29. Wrist/palm rest, if provided, allows you to keep your forearms, wrists, and hands straight and in-line when using the keyboard/input device.		
30. Telephone can be used with your head upright (not bent) and your shoulders relaxed (not elevated) if you do computer tasks at the same time.		
"No" answers to any of these questions should prompt a review of Work Surfaces, Document Holders, Wrist Rests or Telephones.		

Notes:

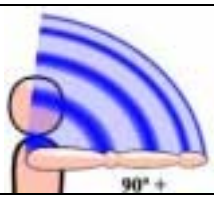
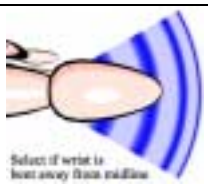
GENERAL	Y	N
31. Workstation and equipment have sufficient adjustability so you are in a safe working posture and can make occasional changes in posture while performing computer tasks.		
32. Computer workstation, components and accessories are maintained in serviceable condition and function properly.		
33. Computer tasks are organized in a way that allows you to vary tasks with other work activities, or to take micro-breaks or recovery pauses while at the computer workstation.		
"No" answers to any of these questions should prompt a review of Chairs, Work Surfaces, or Work Processes.		

Notes:

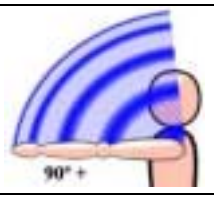
RAPID UPPER LIMB ASSESSMENT

Client:	Date/time:	Assessor:

Right Side:

Right Upper Arm						❑ Shoulder is raised ❑ Upper arm is abducted ❑ Leaning or supporting the weight of the arm
Right Lower Arm					❑ Working across the midline of the body or out to the side	
Right Wrist						❑ Wrist is bent away from midline
Right Wrist Twist			Force & Load for the Right handside	**SELECT ONLY ONE OF THESE:** ❑ No resistance • less than 2kg intermittent load or force ❑ 2–10kg intermittent load or force ❑ 2–10kg static load • 2-10kg repeated loads or forces • 10kg or more intermittent load or force ❑ 10kg static load • 10kg repeated loads or forces • Shock or forces with rapid buildup		
Muscle Use	❑ Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute					

Left Side:

Left Upper Arm						❑ Shoulder is raised ❑ Upper arm is abducted ❑ Leaning or supporting the weight of the arm
Left Lower Arm					❑ Working across the midline of the body or out to the side	
Left Wrist						❑ Wrist is bent away from midline
Left Wrist Twist			Force & Load for the Right handside	**SELECT ONLY ONE OF THESE:** ❑ No resistance • less than 2kg intermittent load or force ❑ 2–10kg intermittent load or force ❑ 2–10kg static load • 2-10kg repeated loads or forces • 10kg or more intermittent load or force ❑ 10kg static load • 10kg repeated loads or forces • Shock or forces with rapid buildup		
Muscle Use	❑ Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute					

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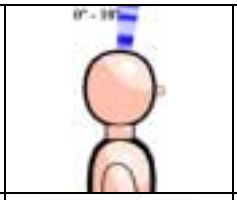
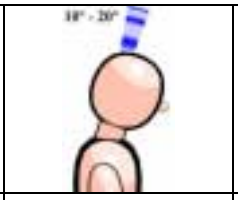
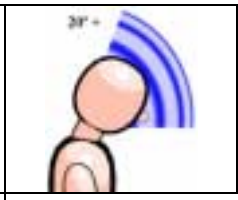
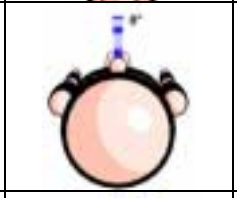
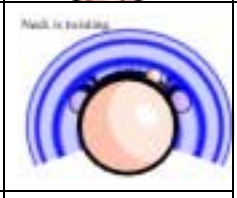
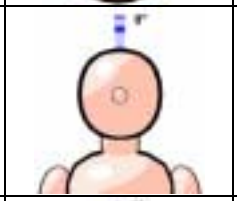
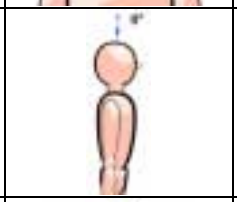
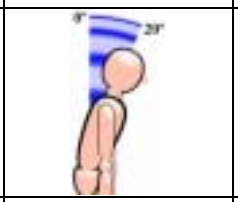
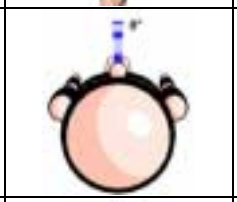
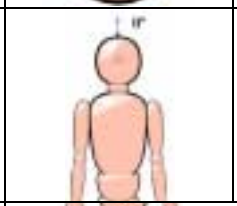
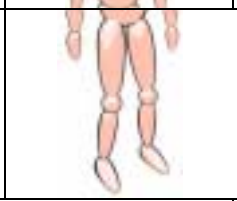
Neck					
Neck Twist					
Neck Side-bend					
Trunk					
Trunk Twist					
Trunk Side-bend					
Legs		Legs and feet are well supported and in an evenly balanced posture.		Legs and feet are NOT evenly balanced and supported.	
Force & Load for the neck, trunk and legs	**SELECT ONLY ONE OF THESE:** ❑ No resistance • less than 2kg intermittent load or force ❑ 2–10kg intermittent load or force ❑ 2–10kg static load • 2-10kg repeated loads or forces • 10kg or more intermittent load or force ❑ 10kg static load • 10kg repeated loads or forces • Shock or forces with rapid buildup				
Muscle Use	❑ Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute				

Whilst COPE Occupational Health and Ergonomic Services Ltd (COPE) and Osmond Group Limited (Osmond) have taken every care in preparing this resource, it must be used according to the guidelines based on the original article* by Prof E.N. Corlett and Dr L. McAtamney.

No responsibility will be taken by COPE or Osmond in the use of this resource.

RULA provides a score of a snapshot of the activity as part of a rapid screening tool. The user should refer to the original article* to check the detail of the scoring and correct use of RULA scores. Further investigation and actions may be required.

For further information on methodology, please refer to our on-line guidance at **www.ergonomics.co.uk** or:
McAtamney, L and Corlett, E.N. Reducing the risks of work related upper limb disorders - A guide and methods. Published by: Institute for Occupational Ergonomics, University of Nottingham, Nottingham NG7 2RD, UK. (1992). Tel: +44 (0)115 9514005 for details.

*McAtamney, L. and Corlett, E.N. "RULA -: A survey method for investigation of work-related upper limb disorders. Applied Ergonomics 1993, 24(2), 91-99

COPE

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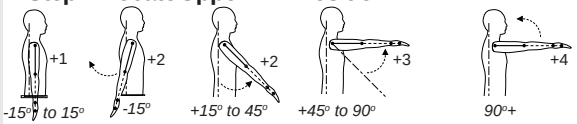
Ergonomic Office Solutions

RULA Employee Assessment Worksheet

Complete this worksheet following the step-by-step procedure below. Keep a copy in the employee's personnel folder for future reference.

A. Arm & Wrist Analysis

Step 1: Locate Upper Arm Position

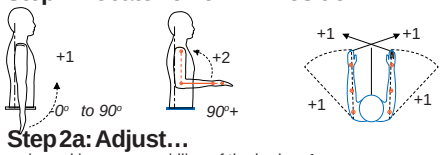


Step 1a: Adjust…

If shoulder is raised: +1;
If upper arm is abducted: +1;
If arm is supported or person is leaning: -1

Final Upper Arm Score = ☐

Step 2: Locate Lower Arm Position

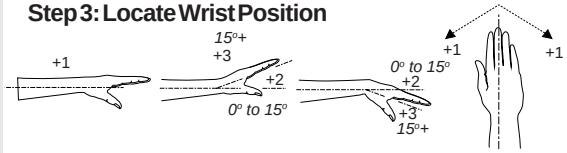


Step 2a: Adjust…

If arm is working across midline of the body: +1;
If arm out to side of body: +1

Final Lower Arm Score = ☐

Step 3: Locate Wrist Position



Step 3a: Adjust…

If wrist is bent from the midline: +1

Final Wrist Score = ☐

Step 4: Wrist Twist

If wrist is twisted in mid-range =1;
If twist at or near end of range = 2

Wrist Twist Score = ☐

Step 5: Look-up Posture Score in Table A

Use values from steps 1,2,3 & 4 to locate Posture Score in table A

Posture Score A = ☐

+

Step 6: Add Muscle Use Score

If posture mainly static (i.e. held for longer than 1 minute) or;
If action repeatedly occurs 4 times per minute or more: +1

Muscle Use Score = ☐

+

Step 7: Add Force/load Score

If load less than 2 kg (intermittent): +0;
If 2 kg to 10 kg (intermittent): +1;
If 2 kg to 10 kg (static or repeated): +2;
If more than 10 kg load or repeated or shocks: +3

Force/load Score = ☐

=

Step 8: Find Row in Table C

The completed score from the Arm/wrist analysis is used to find the row on Table C

Final Wrist & Arm Score = ☐

SCORES

Table A

Upper Arm	Lower Arm	Wrist 1		Wrist 2		Wrist 3		Wrist 4	
		Wrist Twist		Wrist Twist		Wrist Twist		Wrist Twist	
		1	2	1	2	1	2	1	2
1	1	1	2	2	2	2	3	3	3
	2	2	2	2	2	3	3	3	3
	3	2	3	2	3	3	3	4	4
2	1	2	2	2	3	3	3	4	4
	2	2	2	2	3	3	3	4	4
	3	2	3	3	3	3	4	4	5
3	1	2	3	3	3	4	4	5	5
	2	2	3	3	3	4	4	5	5
	3	2	3	3	4	4	4	5	5
4	1	3	4	4	4	4	4	5	5
	2	3	4	4	4	4	4	5	5
	3	3	4	4	5	5	5	6	6
5	1	5	5	5	5	5	6	6	7
	2	5	6	6	6	6	7	7	7
	3	6	6	6	7	7	7	7	8
6	1	7	7	7	7	7	8	8	9
	2	7	8	8	8	8	9	9	9
	3	9	9	9	9	9	9	9	9

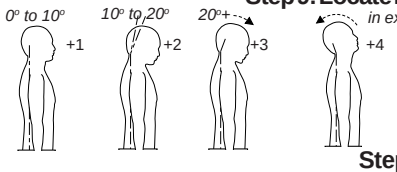
Table C

	1	2	3	4	5	6	7+
1	1	2	3	3	4	5	5
2	2	2	3	4	4	5	5
3	3	3	3	4	4	5	6
4	3	3	3	4	5	6	6
5	4	4	4	5	6	7	7
6	4	4	5	6	6	7	7
7	5	5	6	6	7	7	7
8+	5	5	6	7	7	7	7

Final Score

B. Neck, Trunk & Leg Analysis

Step 9: Locate Neck Position

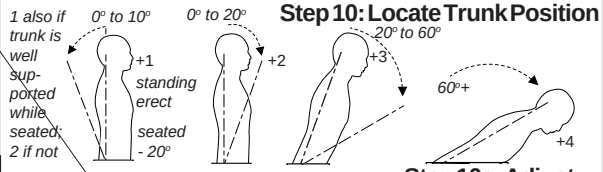


Step 9a: Adjust…

If neck is twisted: +1; If neck is side-bending: +1

☐ *=Final Neck Score*

Step 10: Locate Trunk Position



Step 10a: Adjust…

If trunk is twisted: +1; If trunk is side-bending: +1

☐ *= Final Trunk Score*

Step 11: Legs

If legs & feet supported and balanced: +1;
If not: +2

☐ *= Final LegScore*

Table B

Trunk Posture Score

	1		2		3		4		5		6	
	Legs		Legs		Legs		Legs		Legs		Legs	
Neck	1	2	1	2	1	2	1	2	1	2	1	2
1	1	3	2	3	3	4	5	5	6	6	7	7
2	2	3	2	3	4	5	5	5	6	7	7	7
3	3	3	3	4	4	5	5	6	6	7	7	7
4	5	5	5	6	6	7	7	7	7	7	8	8
5	7	7	7	7	7	8	8	8	8	8	8	8
6	8	8	8	8	8	8	8	9	9	9	9	9

Step 12: Look-up Posture Score in Table B

Use values from steps 9, 10 & 11 to locate Posture Score in Table B

☐ *= Posture B Score*

+

Step 13: Add Muscle Use Score

If posture mainly static or;
If action 4/minute or more: +1

☐ *= Muscle Use Score*

+

Step 14: Add Force/load Score

If load less than 2 kg (intermittent): +0;
If 2 kg to 10 kg (intermittent): +1;
If 2 kg to 10 kg (static or repeated): +2;
If more than 10 kg load or repeated or shocks: +3

☐ *= Force/load Score*

=

Step 15: Find Column in Table C

The completed score from the Neck/Trunk & Leg analysis is used to find the column on Chart C

☐ *= Final Neck, Trunk & Leg Score*

Subject: _____ Date: __/__/__

Company: _____ Department: _____ Scorer: _____

FINAL SCORE: 1 or 2 = Acceptable; 3 or 4 investigate further; 5 or 6 investigate further and change soon; 7 investigate and change immediately

© *Professor Alan Hedge, Cornell University. Nov. 2000*

National Park Service Ergonomics Policy

Parks will implement a program designed to prevent injuries and illness by eliminating or reducing worker exposure to work-related musculoskeletal disorder (WMSD) risk factors; to reduce the potential for fatigue, error and unsafe acts by adapting the job and workplace to the worker's capabilities and limitations; to increase the overall productivity of the work force; and to reduce workers' compensation claims and costs.

Scope

This section provides guidance for park ergonomics programs. It discusses the development of an ergonomics program that focuses on the identification and control of improper workplace and work process design.

Effects of WMSDs

Repeated biomechanical stress and microtrauma cause or aggravate WMSDs. Over time, repeated microtrauma can evolve into a painful, debilitating state involving muscles, tendons, tendon sheaths and nerves. Examples of WMDSs are tendonitis, tenosynovitis, bursitis, chronic muscle strain and nerve entrapment syndromes such as carpal tunnel syndrome.

The expense associated with a poorly designed workplace is considerable and includes both direct and indirect costs. Direct costs include medical treatment, rehabilitation and workers' compensation costs. Indirect costs include lost work time, decreased productivity, decreased work quality, retraining costs and diminished morale.

C. References

1. NIOSH. 1997. *Health Hazard Evaluation Report HETA 97-0199-2680, U.S. Department of the Interior, Yosemite National Park, California*.

2. NIOSH. 1997. *Elements of Ergonomics Programs, 1997. NIOSH PUB 97-117*

3. NIOSH. 1994. *Workplace Use of Back Belts Review and Recommendations Publication No. 1994-122:*

4. Department of the Army. 2000. *Ergonomics program.* DA Pam 40-21

5. ACGIH. 2002. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

6. Brown, B.W., Greitzer, F.L., Pond, D. 1997. *Ergonomics Education, Awareness System Evaluation and Recording* (ErgoEASER2). US Dept of Energy.

Program Elements

1. *Worksite Analysis and Risk Factors.* Conduct an analysis of park facilities and operations to identify jobs and worksites with WMSD risk factors. There are several approaches that may be used to determine whether conditions in the workplace might be contributing to employees developing musculoskeletal disorders. These approaches can be used individually or in combination.

    a. Review and analyze injury and illness records such as OSHA 300 Logs and supporting 301 forms and Workers' Compensation claims to determine whether there is a pattern of ergonomic-related injuries in certain jobs or work tasks.

    b. Analyze jobs or work tasks to identify potential ergonomic problems before employee injuries occur. Determine if jobs present ergonomic risks that may contribute to musculoskeletal disorders. This should be completed as part of Job Hazard Analysis (see Section 3.1)

Analysis tools may help in analyzing jobs. There are numerous analysis tools that may be used to learn more about potential ergonomic risks associated with jobs. An example is ErgoEASER2 software . ErgoEASER2 is a software package that has been developed to aid in identifying, evaluating and preventing work-related musculoskeletal disorders. Evaluating video-display terminal (VDT) workstations and lifting task design, ErgoEASER offers suggestions on how to address ergonomic hazards and reduce worker disabilities.

Seek employee input about the existence of ergonomic problems related to particular jobs or work tasks. This may be accomplished by speaking with employees, conducting symptom surveys, or through employee questionnaires

[1]ErgoEASER2 is available for download at *http://www.osti.gov/estsc/* . Federal Agencies and their contractors may obtain a Government Licensed version of ErgoEASER 2.0 from the U. S. Department of Energy's centralized software management facility (Energy Science and Technology Software Center *http://www.osti.gov/html/osti/estsc/estsc.html*).

The following conditions can contribute to the development of WMSDs. Injury may be more likely when several of these risk factors are combined in the workplace. These disorders include:

a. Repetitive motions, especially during prolonged activities.
b. Sustained or awkward postures.
c. Excessive bending or twisting of the wrists.
d. Continued elbow or shoulder elevation such as in overhead work.
e. Forceful exertions, especially in awkward positions.
f. Excessive use of small muscle groups such as with the pinch grip.
g. Acceleration and velocity of dynamic motions.
h. Vibration.
i. Mechanical compression.
j. Estrictive workstations such as those with inadequate clearances.
k. Improper seating or support.
l. Inappropriate hand tools.
m. Machine-pacing and production –based incentives.
n. Extreme temperatures.
o. Extended exposure to hazardous or annoying noise.

2. *Prevention and Control.* The primary method of preventing and controlling exposure to WMSD hazards is through effective design or redesign of a job or a worksite. There are six methods of controlling WMSD hazards. They should be considered in the order in which they are presented here.

   a. *Process Elimination.* Elimination of the demanding process essentially eradicates the WMSD hazard.

   b. *Engineering Controls.* Ergonomic engineering controls redesign the equipment or worksite to fit the limitation and capabilities of workers. Equipment or worksite redesign typically offers a permanent solution. For example, provide a video display terminal workstation that can be adjusted to a wide range of worker dimensions.

   c. *Substitution.* Substituting a new work process or tool without WMSD hazards for a work process with identified WMSD hazards can effectively eliminate the hazard. For example, replace hand tools that require awkward wrist positions of wrist flexion, extension or deviation, with tools that allow a neutral wrist position.

   d. *Work Practices.* Practices that decrease worker exposure to WMSD risk factors include changing work techniques, providing workforce conditioning programs and regularly monitoring work practices. Also included are maintenance, adjustment and modification of equipment and tools as needed.

1) Proper work techniques include methods that encourage correct posture, use of proper body mechanics, appropriate use and maintenance of hand and power tools and correct use of equipment and workstations.

2) Personnel conditioning refers to the use of a conditioning or break–in period. New and returning seasonal employees may need gradual integration into a full workload, depending on the job and the person. Supervisors, safety officers, industrial hygienists or health care personnel should identify those jobs that require a break–in period.

3) Regular monitoring of operations helps to ensure proper work practices and to confirm that the work practices do not contribute to WMSD or hazardous risk factors.

4) Effective schedules for facility, equipment and tool maintenance, adjustments and modifications will reduce WMSD hazards. This includes ensuring proper working conditions, having sufficient replacement tools to facilitate maintenance, and ensuring effective housekeeping programs. Tool and equipment maintenance may also include vibration monitoring.

e. A*dministrative Controls.* Use administrative controls to limit the duration, frequency and severity of exposure to WMSD hazards. Examples of administrative controls include, but are not limited to:

1) Decreasing production rate requirements and limiting the duration of the process to reduce the number of repetitions.

2) Reducing the number and speed of repetitions by having worker input regarding production speed.

3) Provide for adequate warm-up before engaging in physically demanding tasks.

4) Providing rest breaks to relieve fatigued muscle–tendon groups or to stretch breaks for sedentary tasks. Determine the length of the rest break by the effort required, total cycle time and the muscle–tendon group involved.

5) Increasing the number of personnel assigned to the task (for example, lifting in teams rather than individually).

6) Instituting job rotation as a preventive measure, with the goal of alleviating physical fatigue and stress to a particular set of muscles and tendons. *Do not use job rotation in response to symptoms of WMSD.* This can contribute

to symptom development in all personnel involved in the rotation schedule rather than preventing problems.

7) Providing modified or restricted duty assignments to allow injured muscle–tendon groups time to rest, which assists in the healing process. Make every effort to provide modified or restricted duty assignments when physical limitations as identified by a healthcare provider, allowing the worker to return to work performing less than his or her normal work requirements. In regard to modified or restricted duty assignments:

   i. A healthcare provider should specifically identify assignments or job tasks for the individual worker based on his or her symptoms, capabilities and limitations.

   ii. Healthcare providers with specific knowledge in both occupational demands and cumulative trauma injuries should cooperate with trained ergonomics personnel to develop a list of jobs with low WMSD risk.

f. Personal Protective Equipment. Personal protective equipment (PPE) is not necessarily recommended for controlling exposure to WMSD hazards, since little research has been conducted to support claims of its usefulness.

1) Appliances, such as wrist rests, back belts, back braces, etc., are not considered PPE. Before purchasing such devices, discuss their effectiveness with trained ergonomics personnel. (The NPS does not support the blanket use of back belts as a back injury preventive measure.) Anti-vibration gloves are an example of PPE that addresses WMSD hazards.

2) Consider WMSD hazards when selecting PPE. The PPE should be properly worn or used according to the manufacturers' specifications, available in a variety of sizes, accommodate the physical requirements of personnel and the job, and it should not contribute to WMSD hazards.

3. *Healthcare Management*

Early recognition and healthcare management of WMSDs are critical to reducing the impact of injury on both the employee and the park. Common symptoms of WMSDs can include pain, tingling, numbness, stiffness and weakness in the neck, shoulders, arms, hands, back and legs. Other symptoms can include headaches, visual fatigue and increased errors. Employees should be encouraged to report symptoms of WMSDs early and to seek the services of their personal healthcare provider for evaluation and to determine work-relatedness.

Work-related musculoskeletal disorders do not require a general medical surveillance program. Rather, worksite analysis methods for the identification of problems and risk factors should be used. Periodic worksite surveys to update evaluations and recognize emerging problems should be conducted at least annually. Additional surveillance should be conducted for jobs where there is a high incidence of WMSDs or that have been identified as high risk.

4. *Training and Employee Participation*

Training must be provided to workers who are potentially exposed to WMSD risk factors. Workers must receive instruction in the following topics:

a. Potential risks and possible causes of WMSDs
b. How to recognize and report symptoms.
c. How to prevent WMSDs.
d. Sources of treatment.
e. Demonstration of the proper use and care of all tools and equipment.
f. Correct use of safety equipment (PPE)
g. Safe and proper work procedures, such as proper lifting techniques.

Employees must be encouraged to proactively participate in the park's efforts to reduce work-related injury, disease in general and ergonomic problems in particular. This may be accomplished by promoting direct individual input from employees. For example, knowledge of the work process and equipment characteristics directly support worksite ergonomic evaluations. Workers should also participate in safety committees or similar forums in order to effectively identify and resolve ergonomic issues.