Naval Facilities Engineering Command
Ergonomic Risk Assessment for
Instrument Shop

Introduction

This report summarizes the ergonomic risk assessment conducted at the Instrument Shop in February, 2003. The Instrument Shop was observed in order to determine sources of ergonomic stress and recommend improvements. This assessment is based upon interviews with supervisor, safety specialist, Industrial Hygienist, and employees as well as an evaluation by the Naval Facilities Engineering Command (NAVFACENGCOM) Hazard Abatement Ergonomist.

The Job Requirements Physical Demands Survey (JR/PD), an ergonomic survey, was also administered to the employees in the Instrument Shop. The results of the JR/PD indicate the Instrument Shop as an ergonomic problem area with a score of **9** on a scale of 1 to 9 where 9 is a maximum value. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, legs/feet, and head/eyes For the instrument shop the hand/wrist/arm, leg/foot, and head/eye regions were found to have significant ergonomic risk. Ergonomic risk is based upon ergonomic stressors associated with the task and employee discomfort. While 100% of the employees completed the JR/PD, the small sample size returned non-statistically significant results. New material handling equipment has been purchased since the JR/PD was performed and the employees are no longer reporting discomfort. Anti-fatigue matting is replaced annually and the lights were recently repaired. Appendix I contains a summary of the JR/PD results as well as a description of the methodology.

The Instrument Shop was observed in order to determine sources of ergonomics stress and make recommendations to reduce the risk of work-related musculoskeletal disorders (WMSDs) and improve safety, health and productivity. Musculoskeletal Disorders (MSDs) are injuries and illnesses that affect muscles, nerves, tendons, ligaments, joints, spinal discs, skin, subcutaneous tissues, blood vessels, and bones. Work-Related Musculoskeletal Disorders (WMSDs) are:

- Musculoskeletal disorders to which the work environment and the performance of work contribute significantly or
- Musculoskeletal disorders that are aggravated or prolonged by work conditions.

Recommendations to the command to further reduce the probability of injury include new equipment[i] and administrative controls[ii]. Recommendations are included with as much vendor information[iii] as possible to assist in the evaluation of products and services. Input gathered from the workers, safety specialists, and other personnel to evaluate equipment before purchasing is recommended. This process will increase product acceptance, test product usability and durability, and take advantage of employee experience.

The command may request additional funds from the Chief of Naval Operations (CNO) Hazard Abatement (HA) Program to abate the risk of injury. Naval Facilities Engineering Command (NAVFACENGCOM) manages the CNO Hazard Abatement Program, which is a centrally managed fund to correct safety and health deficiencies beyond the funding capabilities of the activity. Information about the HA program can be found on the Naval Facilities Engineering Command web site www.navfac.navy.mil/safety and in OPNAVINST 5100.23F. Ch 12 Hazard Abatement.

Instrument Shop

Purpose of the Operation: Develop and repair instruments

Population: Three employees working flexible schedule (i.e. 9 hour days and every other Friday off)

Injury Data: One recorded injury according to the Job Requirements and Physical Demands Survey results, which found one employee visiting a health care provider for pain/discomfort that he feels is related to his job.

Description of the Operation:
Workers perform a variety of machining operations in order to develop and repair instruments which requires precision and attention to detail. Instrument shop workers are highly skilled in machine and tool operations. Installation and removal of equipment is frequently performed at different locations outside of the shop. The employees reported the most difficult tasks are lifting and carrying materials and installing and removing telescopes. Employees also reported fatigue after standing at machines for extended periods.

Ergonomic issue description:
Heavy Lifting: Metal stock is kept in a storage area, figure 1, and retrieved by hand. Metal stock can weight up to 40 lbs. and is as long as 20 feet. Metal stock is retrieved infrequently (about once a month) but can involve heavy lifting and awkward postures. The tallest shelf is 94" high which requires excessive reaching while lifting overhead. Climbing a ladder as shown in figure 2, to retrieve stock places the employee at risk of fall. Heavy awkward lifting can strain the back and place the worker at risk of injury.

Figure 1: Metal storage

Figure 2: Storage Area

Static and Awkward Postures: Employees frequently hold sheets of metal in front of machines for cutting or bending as shown in figure 3. Holding heavy metal in a static posture can cause the muscles to fatigue Static sustained postures cause lactic acid to build up in the muscles and reduce blood flow which supplies the muscles with nutrients and carries away waste products. Muscle fatigue can be a precursor to WMSDs.

Employees sitting at their workstations are not always able to rest their feet comfortably on the floor while the chair is adjusted to a comfortable working height for the hands. Sitting with feet unsupported causes blood to pool in the feet. Employees who "tuck" their feet on the base of the chair can cause biomechanical stress on the knees and further reduce blood flow to the feet. Reduced blood flow leads to static muscle loading and muscle fatigue.

Figure 3: Holding metal stock

Figure 4: Sitting at workstation

Impact: Employees occasionally use their hand as a hammer to adjust parts. There are many nerves and veins that run close to the surface of the skin in the palm of the hand. These nerves and veins can be damaged by repeated impact.

Lighting: The majority of the lighting in the Instrument Shop comes from windows; therefore lighting is limited on overcast days. Working at machines, figure 5, with insufficient lighting can cause eye strain and fatigue as well as awkward postures as workers try to get closer to their work. According to an Industrial Hygiene Survey, lighting levels at machines range from 456 to 2180 Lux. Workbench lighting ranged from 982 to 1617lux. The lighting requirements vary depending on the visual demands of the task. Tasks with greater visual demands require higher light levels. Visual tasks of low contrast or small size or very difficult inspection should have lighting levels of 1000 to 2000 lux. If these tasks are performed over long periods of time or include highly difficult inspection, lighting levels should be between 2000 and 5000 lux. Since muscles operate less efficiently in awkward positions, more force is expended to do the task. Awkward postures may also put additional strain on the tendons, which can cause inflammation, swelling, restricted movement, and pressure on nearby nerves and if occurring often can lead to WMSDs.

Figure 5: Lathe

<u>Recommendations:</u>

- A height adjustable table could be used to support the weight of the metal sheets while loading machines. See table 1
- A height adjustable footrest for seated workstations will allow the workers to rest their feet comfortably without having to “tuck” their feet onto the base of the chair. See table 2.
- A step ladder and a sling would allow workers (in teams) to pull metal stock in a safer manner than a single worker using a ladder. Refer to table 3
- Additional overhead lighting and task lighting with variable level and positioning would allow the workers to select the light level appropriate for the task, thus reducing eye strain and awkward postures. Refer to table 4

- Employees should be encouraged not to use their hand as a hammer. A soft rubber mallet can adjust parts without damaging them. Basic ergonomics awareness training can be downloaded and delivered to the employees from the Navfac Ergononomics website.

  http://www.navfac.navy.mil/safety/site/ergo/training.htm

- Encourage workers to take stretching breaks during the day to relieve discomfort and encourage muscle movement. A physical therapist can instruct the workers in stretching exercises appropriate for their job or refer to the following websites. The following web sites include exercises that can be printed and posted. Sources should be cited when reproducing information. Web site links updated Jan 2002.

  http://www.steelcase.com/servlet/ToolsInsightsServlet?ACTION=5&CONTENT_ID=202

  www.shelterpub.com/_fitness/_office_fitness_clinic/OFC_online_stretches.html

  http://www.ucsc.edu/opers/wellness/pages/officestretches.html

  www.safety.duke.edu/Ergonomics/90seconds.asp

Table 1: Instrument Shop Recommendations

Description	Vendor	Product	Estimated Cost	Figure
Height Adjustable Carts	Lab Safety 1-800-356-0783	Bishamon Mobile Scissor Lift Tables 1650 lb. Capacity 20.5”x40” platform Height adjustable 16.5” to 39”	$1075	
	C&H 1-800-558-9966	Southworth Dandy Lift Mobile Lift Truck 1760 lb. capacity 23”x39” platform Height adjustable 13” to 40”	$1228	
	PeakLogix 703-819-6061	Southworth Dandy Lift Mobile Lift Truck 1760 lb. capacity 23”x39” platform Height adjustable 13” to 40”	$998	

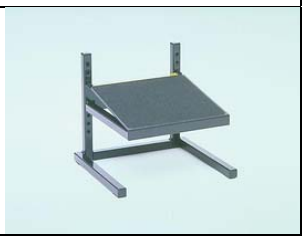
Table 2: Footrests				
Description	**Vendor**	**Product**	**Estimated Cost**	**Figure**
Footrest	Alimed 1-800-225-2610	Factory Footrest	$100	
	Your local office supply store	Footrest		

Table 3: Step Ladder				
Description	**Vendor**	**Product**	**Estimated Cost**	**Figure**
Step Ladder with handrails	C&H 1-800-558-9966	Mobile Office Stands (available in different heights) 2 Steps with handrails 73-736DA	$144	
	Peak Logix	Contact Ernie Taylor at 703-819-6061 for pricing		

Table 4: Lighting				
Description	**Vendor**	**Product**	**Estimated Cost**	**Figure**
Machine lighting	ProLine	Contact Ernie Taylor at 703-819-6061 for pricing		
	Light Specialties (800)214-4522	Dazor Wide Beam or Narrow Beam Bullet Reflector	$128-158	

*Some information has been removed from this report that is specific to the activity.

[i] Equipment purchase without proper and repeated training will not mitigate risk and may in fact increase hazards.

[ii] Administrative controls are management-controlled work practices and policies designed to reduce exposures to work-related musculoskeletal disorders (WMSDs) hazards by changing the way work is assigned or scheduled. Administrative controls reduce the exposure to ergonomic stressors and thus reduce the cumulative dose to any one worker. Examples of administrative controls that are used in the ergonomics context are employee rotation, employer-authorized changes in the pace of work, and team lifting.

[iii] This report does not constitute an endorsement of any particular product. Rather, it is a recitation of how Navy personnel have addressed a particular work place safety issue. Neither the Navy nor its employees and agents warrant any product described in this report for any use, either general or particular.