

CHAPTER 23

ERGONOMICS PROGRAM

2301. Background and Discussion

a. This program seeks to prevent injuries and illnesses by applying ergonomic principles to identify, evaluate and control ergonomic risk factors for work-related musculoskeletal disorders (WMSDs). These risk factors are workplace conditions that pose a biomechanical stress to a worker's body as a consequence of posture and force requirements, work/rest regimens, repetition rate or other similar factors. Examples of ergonomic risk factors for WMSDs include:

(1) Tasks involving one or more of the following: repetitive and prolonged static activities, forceful exertions, awkward postures, excessive vibration from power tools or vehicles, and workstations lacking adjustability

(2) Physiological stress induced by heat, cold or other environmental extremes, shift work and extended work schedules.

Injuries can be reduced in Navy workplaces through a systematic application of ergonomic techniques. Ergonomics is the study of work and workplace design in relation to the physiological and psychological capabilities of people. The goal of the ergonomics program is the scientific design of the workplace, machines and work tasks with the capabilities and limitations of the human being in mind.

b. Since the requirements of this chapter affect the conditions of employment of civilian employees, commanding officers have an obligation under the Federal Service Labor-Management Relations Statute, 5 U.S.C., Chapter 71, to advise

unions representing civilian employees of changes affecting conditions of employment, and to fulfill any requirement for collective bargaining prior to implementation.

c. Work-related WMSDs are disorders of the musculoskeletal and nervous system occurring in either the upper or lower extremity and the spine. This category of injuries includes both cumulative trauma disorders (CTD) and over exertion injuries (sprains and strains). CTD (micro-trauma) CTD can be defined as any combination of stresses applied to the body over a period of time from which adequate recovery does not occur. There are two types of CTD's. These are repetitive stress and repetitive motion injuries, caused by excessive movement such as typing, using a screw driver, etc. and sustained position injuries caused by sitting or standing in one position for long periods of time. Overexertion Injury (macro-trauma) is divided into two categories, sprains and strains. Sprains and strains are caused by frequent or heavy lifting, pushing, pulling or carrying of heavy objects. Examples of WMSDs include but are not limited to: tendinitis, tenosynovitis, bursitis, hand arm vibration syndrome (HAVS), Raynaud's Syndrome of occupational origin, vibratory white finger (VWF), lower back strain, carpal tunnel syndrome, throacic outel syndrome, disc injuries, tennis elbow, golfers elbow, trigger finger and De Quervain's Disease. The term "WMSDs" refers specifically to:

(1) Musculoskeletal disorders to which the work environment and the performance of work contribute significantly

(2) Musculoskeletal disorders that are aggravated or prolonged by work conditions.

These workplace risk factors, along with personal characteristics (e.g., physical limitations or existing health problems) and societal factors, as well as moral issues, are thought to contribute to the development of WMSDs. They also reduce worker productivity and/or cause worker dissatisfaction.

d. Except for back injuries, workers typically do not associate symptoms of WMSDs with their work. Consequently, injury reports are not a reliable method to identify victims of WMSDs. Therefore, it is necessary to train workers to recognize and report symptoms of excessive fatigue, discomfort and pain before injury occurs. Likewise, supervisors should be trained to recognize risk factors and other certain signals and early warning signs that injury might be occurring. For example, supervisors should be aware that an employee who rubs his or her wrists or eyes periodically, stretches his or her back and shoulders, exhibits other pain gestures, or complains of pains or discomfort of unknown origin might be suffering from WMSDs.

e. The Navy ergonomics program elements are: management commitment and employee involvement, work site analysis, hazard prevention and control, medical and case management, and training. Case management is an important element of ergonomics. Case management is staying closely involved and informed after an employee injury, assisting the employee in the recovery and return to work, both for the well-being of the employee, and to control the costs associated

with the injury and recovery (workers' compensation).

2302. Management Commitment and Employee Involvement

a. Aggressive and coordinated management actions are necessary to prevent WMSDs and to control claims and costs related to these injuries. Management commitment provides the organizational resources and motivating force necessary to deal effectively with WMSD risk factors. Employee involvement and feedback are likewise essential, both to the identification of existing and potential hazards, and to the development of an effective means for their abatement. A properly trained worker is the cornerstone of a successful in-house program.

b. Private sector organizations with well-established ergonomics programs report that implementing ergonomics principles into processes increases productivity and reduces medical costs. Expected benefits for the Navy would also include productivity gains and reductions in injury compensation costs.

c. Some projects developed to address ergonomic hazards that exceed the funding capability of local organizations may qualify for centrally-managed Navy occupational safety and health (NAVOSH) funds. Applications for these funds should be submitted per the procedures of chapter 12, Hazard Abatement Program.

d. Methods to involve employees in an ergonomics program include:

(1) Properly training safety and health committees to review and analyze ergonomic problem areas and recommend corrective actions to management

(2) Establishing worker-based ergonomic teams, with proper training. These teams have been demonstrated to successfully identify and assist in correcting ergonomic problems.

R) e. Implementation of an effective program requires access to a technically qualified staff. The Navy provides ergonomics training to safety and health professionals. When the occupational safety and health (OSH) office or other internally available staff do not have the professional expertise to identify or correct WMSDs, they should obtain outside assistance to evaluate workstations and job tasks for ergonomic stressors causing or capable of causing injury or illness. -

f. The activity commanding officer should define and approve the parameters selected to measure progress of the command's ergonomics program, together with specific goals for improvement during the remainder of the year and include them in command OSH improvement plans.

g. Each activity shall carry out an aggressive, comprehensive, and integrated program to manage and control compensation claims, ensuring proper review, processing and administration by cognizant personnel offices.

2303. Work Site Analysis

a. Each activity shall conduct an annual analysis of its injury and illness records. This analysis shall include both injury/illness log records (OPNAV 5102/7) and medical injury compensation records. The analysis shall include the identification of WMSDs and ergonomic risk factors. The

analysis should identify specific departments, codes, or operations experiencing WMSDs to target them for training, medical surveillance and engineering studies to eliminate hazards. The analysis should also identify:

- (1) Body part involved
- (2) Nature of injury/illness
- (3) Time of day (including work shift) that symptoms developed
- (4) Frequency
- (5) Severity
- (6) Physical location
- (7) Description of job(s)
- (8) Cost of treatment.

b. An activity shall consider observations made during safety inspections and other factors, such as absenteeism, high personnel turnovers, fitness and age of workers in the identification of WMSDs. The command may also elect to survey personnel in occupations known to have high WMSD risks to determine if they have experienced unreported warning signs or injuries they did not relate to their work. An example survey form is provided in appendix A. The discomfort survey and analysis may identify areas where ergonomic efforts are necessary. The activity should use the survey data to target departments or codes where personnel are at higher risk of WMSDs.

2304. Workplace Analysis

a. Activities shall conduct thorough WMSD analysis of workplaces as part of, or in conjunction with, the workplace inspections required by chapter 9 and industrial hygiene surveys required by chapter 8. The analysis shall include the identification of risk factors such as awkward posture, sustained positions, excessive force, excessive repetition, contact stress, segmental or whole body vibration, and environmental issues such as temperature extremes, poor lighting and excessive noise. Analysis shall also identify unsafe employee behavior or acts, such as bending, twisting, over reaching, elbows over shoulder level, excessive pinch gripping and overexertion.

b. Activities shall use appendix 23-B during workplace safety and health inspections to identify ergonomic risk factors that they can reduce or eliminate. Activities shall assign Risk Assessment Codes (RAC's) and track actions to reduce WMSD risk factors using the existing hazard abatement tracking methods in chapter 9 and 12 of this manual. If the action(s) necessary to reduce or eliminate WMSD risk factors are not readily apparent, activities may schedule an in-depth ergonomics analysis. Activities should perform this in-depth analysis using guidance provided in appendix 23-C. Activities should also complete detailed analyses for cases where WMSDs have already been observed and work station modification is necessary to prevent similar illness to others and/or allow workers to return to unrestricted status.

c. Activities can use the WMSD analysis process to identify low risk work areas to allow injured workers assigned or permitted to return for light duty early return to work.

d. Activities should consider shift work-related stressors and injuries when

determining scheduling policies and implementing other actions to ensure that a safe and healthful workplace is provided (see appendix 23-D).

2305. Hazard Prevention and Control

a. Corrective actions for ergonomic risk factors include (in preferred order of priority): process elimination, engineering controls, substitution of materials/tools/equipment, improved work practices and administrative controls (e.g., lifting restrictions, adjustment of work-rest cycles, slowing work pace, job rotation).

NOTE:

Activities shall not use back support belts or wrist splints as personal protective devices in the prevention of back or wrist injuries. These devices are considered medical appliances, and must be prescribed by a credentialed health care provider who shall assume responsibility for medical clearance, proper fit of the device, and treatment, monitoring and supervision of the wearer.

b. Engineering Controls. Engineering controls are the preferred mechanism for controlling ergonomic risk factors. These controls may entail redesign of workstations, work methods, and tools to control/eliminate the risk factors. References 23-1 through 23-6 contain detailed guid-

(R)

ance on principles/techniques for implementing engineering controls.

(1) Workstation Design. Workstations should be easily adjustable to accommodate the person performing a specific task or job, not just the average worker. Generally, design limits are based upon a range from the 5th percentile female to the 95th percentile male values for critical body dimensions. The work space should be large enough to allow the full range of required movements. Anthropometric data and design recommendations for military equipment and facilities can be found in reference 23-2. This reference also includes design criteria for task illumination, vibration levels, noise levels and ventilation. Adequate illumination for highly visual tasks may be one of the primary concerns for some workstations. Both the quantity and the quality of light are important. Glare, contrast, and shadows influence lighting quality and can seriously diminish performance. Illumination problems should be corrected using guidance published by the Illuminating Engineering Society in references 23-3 and 23-4.

(2) Design of Work Methods. Traditional work method analysis, which requires consideration of static postures and repetition rate, should be supplemented by addressing the force levels and the hand and arm postures involved to identify tasks that can be altered to reduce the stresses associated with WMSDs. When tasks are modified to reduce WMSD stresses and/or "low risk" tasks are found, information needs to be provided to the cognizant medical command or facility so that medical personnel are aware of light or restricted-duty jobs to which injured workers may be assigned. Where tasks are altered, consideration should be given to possible changes in the time required to perform the tasks. WMSD reduction benefits may not be realized if safety-related steps are

added to the process, but sufficient time is not allowed to perform such tasks.

(3) Tool Design and Handles. Properly designed tools and handles increase worker productivity by extending and amplifying manipulative abilities. Activities shall pay proper attention to the selection and design of tools and workstation layouts to minimize WMSD risks and back injuries. Activities shall select or design tools and handles to minimize or eliminate the following stressors in both male and female workers (paying special attention to the size, strength, etc., difference between the two sexes):

- (a) High contact forces and static loading
- (b) Extreme or awkward joint positions
- (c) Repetitive action of the fingers, wrist and arm
- (d) Tool vibration
- (e) Excessive grip strength requirements.

NOTE:

Activities can accomplish many workstation and job procedure designs using a "common sense" approach to ergonomics based on an understanding of human anatomy and physiology without resorting to time-consuming and expensive measurements (this is the cornerstone of the Navy

Program). For example, activities should select hand tools to distribute the applied forces over a wide area of the hand regardless of the job being performed. It is not necessary, in most cases, to actually measure the forces. Another approach is to borrow a variety of equipment, such as ergonomically-designed chairs from prospective suppliers and let the users try them out. The users comfort is often the best guide to proper design.

R) c. Administrative Controls. Activities shall only consider administrative controls, such as rotating employees to jobs with dissimilar physical requirements, establishing work/rest schedules or training employees to use appropriate work methods when process elimination or engineering controls are not feasible. Where heavy objects must be handled, activities may calculate an action limit using methods contained in reference 23-7 to specify the maximum lift an unassisted individual should attempt. While some heavy lifts cannot be avoided, many lifting operations can be designed to include the assistance of other personnel or the use of mechanical handling equipment. It is also common sense to label the actual weight of any object that a worker needs to lift or carry. Another control measure is to ensure that material in storage is stacked off the floor and placed at no less than the knuckle height of the 95th percentile male.

d. Planned Facility Modifications and Equipment Purchases. When activities develop plans for new or modified facilities, processes, jobs, tasks, materials and equipment, they should analyze such plans for opportunities to eliminate or reduce ergonomic hazards. For example, when purchasing office furniture and/or data processing equipment to equip new facilities or replace worn-out equipment, activities should consider selecting equipment that

allows easy adjustment of chair height, keyboard position and video display screen position. Reference 23-2 provides further information on this topic.

2306. Training

a. A key to establishing an ergonomics program is the proper training of managers, supervisors, professional staff, ergonomic teams and all employees. Much of the ergonomics program training is an attempt at behavior modification. Consequently, activities need to devise techniques to enable supervisors and peers to reinforce and demonstrate behavior modifications learned in the classroom. Activities shall integrate training into existing job training whenever possible, including new employee orientation programs. General ergonomics training includes:

- (1) Ergonomics definition and concepts
- (2) WMSD and back injury prevention
- (3) The varieties of WMSD, causes, early symptoms, warning signs, means of prevention and treatment
- (4) Ergonomics of hand tools
- (5) Equipment design, adjustability and layout

(6) Proper maintenance of facilities, equipment and tools as a technique to minimize ergonomic stress

(7) Ergonomic risk factors identification and performing an ergonomic analysis through the use of classroom and field studies, learn to perform an Ergonomic Analysis

(8) The importance of an effective case management process

(9) Safe and unsafe ergonomic behaviors of employees

(10) The basic structures of the body, how they work and how they are affected by ergonomically related disorders

(11) The benefits of a team approach to ergonomics.

b. Activities shall target training in back injury prevention and care for personnel at risk for back injury. Training in back injury prevention shall include the following, as a minimum:

(1) Anatomy and physiology to explain how the musculoskeletal system works and early warning signs of back injury and principles of ergonomics

(2) Biomechanics of lifting and lifting techniques

(3) How to avoid back injuries on and off the job

(4) Wellness: weight control (how to lose weight, control weight loss, and its relationship and importance in back injury prevention)

(5) Health and physical fitness.

c. Activities shall determine training requirements for managers, supervisors

and affected employees based on the results of the work site analysis conducted per section 2303. Where the need for training is indicated, activities shall incorporate appropriate ergonomics training into the NAVOSH training of these personnel, per Chapter 6. Activities shall consider the following when developing training to support ergonomics programs:

(1) Managers. Managers should receive sufficient training on ergonomic issues to effectively carry out their responsibilities for the health and safety of their employees.

(2) Supervisors. Supervisors who have employees with potential exposure to identified ergonomic risk factors for MSWDs, should receive sufficient training to enable them to recognize hazardous work practices and the symptoms of WMSDs, determine steps needed to remove ergonomic risk factors, and to reinforce the ergonomics program. Supervisors should also understand job hazard analysis and use it as a formal instructional tool. Supervisors should receive specialized training in WMSD and back injury prevention, including the demonstrated benefits of physical fitness, health education and lifestyle modification in reducing back injuries and WMSDs.

(3) Employees. Activities shall provide training and formal education, describing various risk factors associated with their jobs, tools, tasks, processes and equipment to employees potentially exposed to ergonomic risk factors for WMSDs. Activities shall also instruct these employees in the varieties of WMSDs, and the means of prevention, causes, early warning signs and treatment of WMSDs. Activities shall document

training provided per the requirements of chapter 6.

(4) Occupational Safety and Health Professional Staff. OSH professional staff responsible for conducting the ergonomics program shall receive formal training on the recognition and control of ergonomic risk factors in Navy work places. Training is available from the Naval Occupational Safety and Health and Environmental Training Center (NAVOSH-ENVTRACEN), course number (A-493-0024 – Ergonomics). Industrial hygiene personnel responsible for performing worksite evaluations shall also receive appropriate training to perform this function.

(5) Healthcare Providers. Cognizant healthcare providers shall be given information on the potential ergonomic risk factors for WMSDs and details of the ergonomics program of each line activity that they support. The activity OSH office shall encourage health care providers to seek special training covering diagnosis, treatment and rehabilitation of WMSD cases.

(6) Facility Engineers. Engineering staffs responsible for planning, designing, or writing specifications for equipment, tools, jobs, tasks and processes shall receive formal training and instructions in methods of eliminating or reducing ergonomic risk factors for WMSDs in the work place, as well as basic physiology and body mechanics (human factors).

2307. Medical Program

a. Cognizant medical commands shall support line activity initiatives to reduce WMSDs by providing medical preplacement examinations, medical monitoring of employees judged to be at high risk for WMSDs and facilitating rehabilitation of individuals with WMSDs. Health care providers (occupational medicine physicians,

physician assistants, nurse practitioners, physical therapists and occupational health nurses) shall conduct work place visits to obtain knowledge of operations, work practices and light-duty jobs, at activities they support to provide ergonomics assessments.

b. Physical Standards Preplacement Examinations. Cognizant medical commands shall perform preplacement examinations to ensure that personnel meet the physical requirements for the position in which they are placed. Where analysis of mishap data identifies positions that involve significant risk of WMSDs, the employing activity and the cognizant medical command shall review the presence and/or adequacy of existing physical standards. When requested, the cognizant medical command shall also review history, e.g., history of back injuries, and/or performance test criteria and strength tests suitable for reducing risk of WMSDs in those positions.

NOTE:

As warranted, consistent with the provisions of Federal Personnel Manual (FPM) Chapter 339, Medical Qualification Determinations, activities may establish physical requirements for civilian positions. Activities may also require personnel who occupy a position with physical or medical standards, physical requirements, or personnel

who are under a medical surveillance program, to undergo medical evaluation periodically, or whenever there is a direct question about a person's continued capacity to meet the physical or medical requirements of the position. FPM Chapter 339 also contains requirements related to employees who request changes in working conditions for medical reasons or special treatment, including reasonable accommodation on the basis of full or partial recovery from a medical condition. The Equal Employment Opportunity Commission requires agencies to make reasonable accommodation to the known physical limitations of qualified handicapped applicants unless an activity can demonstrate undue hardship on the operation of its programs.

R) c. Any employee on injury compensation or assigned to light duty, for whom the activity has identified a position that it reasonably believes the employee can perform, can be required to report for medical evaluation. Reference 23-8 contains suggested guidelines for medical management of WMSDs cases including the following:

(1) Diagnostic tests for initial assessment of WMSDs cases

(2) Conservative treatment protocols using heat or cold, nonsteroidal anti-inflammatory agents, physical therapy, splints and job reassignment

(3) Follow-up protocols after 2, 6, and 8 days

(4) Requiring second opinion for carpal tunnel release surgery

(5) Rehabilitation after surgery.

d. Health Education for Ergonomic Hazards. Each cognizant medical command shall provide, to the extent possible, health education and lifestyle modification information to individuals with WMSD symptoms. A wellness program supports an ergonomics program. A comprehensive wellness program should include weight control, physical fitness, smoking cessation (very important in WMSD injury prevention efforts) and stress management.

e. Rehabilitation of Injured Employees. The Navy encourages cognizant medical commands to offer medical counseling and physical therapy services to rehabilitate employees with WMSDs. Where such services are not available from the cognizant medical command, activities may contract for physical therapy services, provided the cognizant medical command has an opportunity to review the procurement specification prior to solicitation.

f. Monitoring for Trends. Health care providers shall periodically, e.g., monthly, review sign-in logs to monitor WMSD trends. Activity OSH personnel shall perform a similar review as part of their routine analysis of mishaps and Safety Reports of personal injury, death, or occupational illness. Activities shall record most WMSDs on the injury illness log (OPNAV 5102/7) as an occupational illness (disorders associated with repeated trauma).

2308. Responsibilities

a. Echelon 2 and other headquarters commanders shall provide appropriate assistance to subordinate commands to ensure the effectiveness of this program, including the following:

(1) Review injury and compensation data for subordinate activities and, where warranted by data review, direct activities to implement an ergonomics program.

(2) Coordinate program implementation among similar activity types; disseminate information on process improvements to eliminate duplication of effort.

(3) Provide guidance and assistance to subordinate commands on program development and implementation (e.g. identify qualified ergonomists, sponsor technical assistance contracts to address generic requirements within the command, provide manuals on design of workstations, catalogues of ergonomically designed tools and checklists for ergonomic screening surveys).

(4) Include ergonomics program elements (the establishment of ergonomics programs by subordinate commands or the implementation of improved shift work scheduling practices) in command goals and review progress toward achieving these goals during scheduled Occupational Safety and Health Management Evaluations required by chapter 9.

R) (5) Ensure that ergonomic design criteria are considered during procurement initiatives per reference 23-9.

b. Commander, Naval Supply Systems Command shall take appropriate actions to increase the availability of ergonomically-designed furnishings, equipment

and tools through the supply system. Conversely, commands shall take efforts to purge the supply system of ergonomically incorrect equipment such as back belts.

c. Commander, Naval Facilities Engineering Command shall:

(1) Perform comprehensive ergonomic risk analysis of WMSD factors as part of the facility design process. (R)

(2) Review plans for new or modified facilities, processes, jobs, tasks, tools, materials and equipment to ensure that changes will reduce or eliminate ergonomic risk factors for WMSDs.

(3) Develop and implement a Navy-wide program to minimize ergonomic stress through facility design equipment selection and facility, equipment and tool maintenance, e.g., by training engineers on ergonomic principles and techniques that can be applied during the design of new facilities.

d. Chief of Naval Education and Training (CNET) shall provide ergonomics training through the NAVOSH-ENVTRACEN and incorporate WMSD prevention training in all levels of training.

e. Chief, Bureau of Medicine and Surgery (BUMED) shall:

(1) Develop technical and administrative guidance for the medical aspects of the ergonomics program (including medical screening procedures for WMSDs and back injury).

(2) Budget adequate resources for medical facilities to implement this policy.

(3) Provide guidance for the review of medical records for WMSDs information and trends.

(4) Provide medical support by developing, or assisting in developing, therapy and treatment programs. Develop a medical role in the rehabilitation of WMSD cases. Provide medical support by developing therapy and treatment programs, including provision of physical therapists who perform in-house physical therapy to injured employees, serve as part of the education team providing training to prevent injuries and ergonomically evaluate return-to-work capabilities.

(5) Develop training for Navy medical care providers on diagnosis, treatment and rehabilitation of individuals with WMSDs.

(6) Evaluate ergonomic stressors such as noise, vibration and illumination quality as part of scheduled industrial hygiene surveys.

f. Commander, Naval Safety Center shall:

(1) Conduct a mishap analysis program, reviewing available data for a 5-year period, to identify WMSDs by activity and command, including number, type, injured body part, age group, and operation performed. Arrange for data on WMSD types other than back injury to be coded in FY95 and for 5-year summaries for all types of WMSDs to be available by FY00.

(2) Distribute a quarterly WMSD injury report to Echelon 2 commands. Provide the data supporting this report in elec-

tronic format upon request from Echelon 2 commands

g. Commanding Officers of Medical Commands, activities, and treatment facilities shall:

(1) Monitor WMSD trends using appropriate logs or records.

(2) Verify low risk of light duty assignments.

(3) Provide health education for personnel with a past history or current symptoms of WMSDs.

(4) Assist line activities in the rehabilitation of WMSD cases and the implementation of limited or light duty programs.

(5) Assist, as requested by line activities, in the development of physical requirements for positions.

h. Commanders, Commanding Officers and Officers in Charge shall:

(1) Annually, analyze injury and illness records and other pertinent information to determine the need for ergonomic improvements and corrective actions within the activity. Identify the numbers, frequency, type, location and cost of WMSD cases that have occurred during the past 5 years. Additionally, review all screening surveys for ergonomic requirements.

(2) Establish an ergonomics program per this chapter, starting with the appropriate departments/shops/codes within the activity that have the highest potential for WMSDs (as determined by employee discomfort surveys) or the

(R)

highest incident rate of WMSDs. Identify and budget resources to administer an effective ergonomics program consistent with the guidance in this chapter. The command's ergonomics program shall target those areas, operations or personnel with the highest frequency of WMSD injuries or symptoms. Installations with fewer than 100 employees are exempt from these requirements; however, commanders of such activities should use these recommendations as needed to preclude CTDs.

(3) Where labor organizations are present, discharge bargaining obligation under Federal Labor-Management Relations Statute Chapter 71 of Title 5 U.S.C. prior to implementation of any change in work practice or condition of employment.

Chapter 23

References

23-1. American Conference of Governmental Industrial Hygienists, Ergonomic Interventions to Prevent Musculoskeletal Injuries in Industry, Lewis Publishers, Chelsea, MI, 1987 (NOTAL)

23-2. Department of Defense, Military Standard, Human Engineering Design Criteria for Military Systems, Equipment and Facilities, MIL-STD-1472D, 14 March, 1989 (NOTAL)

23-3. Illuminating Engineering Society, IES Lighting Handbook, 5th ed., New York, 1972 (NOTAL)

23-4. American National Standards Institute (ANSI), American National Standard Practice for Industrial Lighting, A11.1-1965 (R 1970), Illuminating Engineering Society, New York, 1970 (NOTAL)

23-5. American National Standards Institute (ANSI)/Human Factors Society 100-1988, American National Standard for Human Factors Engineering of Visual Display Terminal Workstations (NOTAL)

23-6. NIOSH Publication No. 97-117 of March 97, Elements of Ergonomics Programs – A Primer Based on Workplace Evaluations of Musculoskeletal Disorders (NOTAL) (A)

23-7. National Institute for Occupational Safety and Health, A Work Practices Guide for Manual Lifting. Tech. Report No. 94-110, U.S. Department of Health and Human Services, Cincinnati, OH, 1981 (NOTAL)

23-8. U.S. Department of Labor, OSHA Ergonomics Program Management Guidelines for Meatpacking Plants, OSHA Publication 3123, U.S. Department of Labor, Occupational Safety and Health Administration, 1990 (NOTAL)

23-9. DoD Ergo Human Factors MILSTD 1088

**Appendix 23-A
Occupational Survey**

Employee Discomfort Survey

Based on an average day, please inform us about your comfort at work. If you have discomfort not related to your work please explain. Fill in all of the boxes below. Please respond honestly and thoughtfully.

Date _____

Dept. _____

Name _____

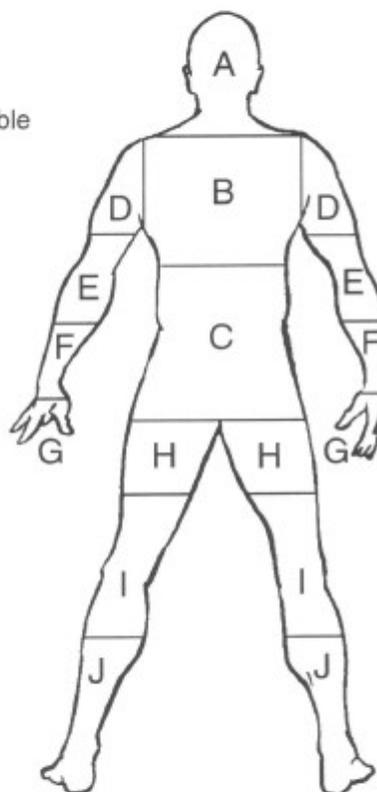
Rate your comfort for **each** region (A – J) by writing a number (0 to 10) in the box provided.
(Make no distinction between right and left)

0 - 5 discomfort
6 - 10 pain

DISCOMFORT RATING

Very Uncomfortable Very Comfortable

- | | | | | |
|-------------------------|--------|----------------------|-------|---|
| A) Head / neck / eyes | 10 ... | <input type="text"/> | | 0 |
| B) Upper / mid back | 10 ... | <input type="text"/> | | 0 |
| C) Low back / pelvis | 10 ... | <input type="text"/> | | 0 |
| D) Shoulder / upper arm | 10 ... | <input type="text"/> | | 0 |
| E) Elbow / mid arm | 10 ... | <input type="text"/> | | 0 |
| F) Forearm / wrist | 10 ... | <input type="text"/> | | 0 |
| G) Hand | 10 ... | <input type="text"/> | | 0 |
| H) Upper leg / hip | 10 ... | <input type="text"/> | | 0 |
| I) Mid leg / knee | 10 ... | <input type="text"/> | | 0 |
| J) Lower leg / foot | 10 ... | <input type="text"/> | | 0 |



Please respond to each of these questions in the boxes provided.

K) How hard is your work? (physically or mentally) 10 Very Much 0 Very Little
Circle One

L) How much energy do you have left after work? 10 Very Much 0 Very Little

M) How would you rate your job satisfaction? 10 Very High 0 Very Low

List ways we can help to make your work more comfortable, safe, and more productive:

1. _____

2. _____

3. _____

4. _____

5. _____

ERGONOMICS ANALYSIS WORKSHEET



Date: _____ Time: _____ Analyst Names: _____
Analysis No. _____ Initial Analysis: _____ Follow-Up Analysis: _____

1. Job Description

- a. Employee Name: _____
- b. Describe Task or Job: _____
- c. Work Schedule: _____
- d. Work Experience: _____

2. Problem Identification

a. Interview	b. Risk Factors	c. Unsafe Behaviors	d. Unsafe Conditions
<input type="checkbox"/> Fatigue	<input type="checkbox"/> Awkward Position	<input type="checkbox"/> Bending	<input type="checkbox"/> Unnecessary Task
<input type="checkbox"/> Discomfort	<input type="checkbox"/> Sustained Position	<input type="checkbox"/> Twisting	<input type="checkbox"/> Employee Fix
<input type="checkbox"/> Pain	<input type="checkbox"/> Force	<input type="checkbox"/> Overreaching	<input type="checkbox"/> Housekeeping
<input type="checkbox"/> Injury	<input type="checkbox"/> Repetition	<input type="checkbox"/> Wings Up	<input type="checkbox"/> Trip/Fall Hazard
<input type="checkbox"/> Disability	<input type="checkbox"/> Contact Stress	<input type="checkbox"/> Pinch Grip	<input type="checkbox"/> Eyes on Work
<input type="checkbox"/> Pain Gesture	<input type="checkbox"/> Vibration	<input type="checkbox"/> Over Exertion	<input type="checkbox"/> Maintenance/Repair
<input type="checkbox"/> Job Dissatisfaction	<input type="checkbox"/> Physical Condition	<input type="checkbox"/> Improper Tool Use	<input type="checkbox"/> Line of Fire
<input type="checkbox"/> Learned Helplessness	<input type="checkbox"/> Environment	<input type="checkbox"/> Improper Procedure	<input type="checkbox"/> Traditional Safety
<input type="checkbox"/> Other	<input type="checkbox"/> Psychosocial	<input type="checkbox"/> Rushing	<input type="checkbox"/> PPE

Describe Recommendations:

15 January 1999

3. Recommendations

Suggestions			
<input type="checkbox"/> Eliminate Task	<input type="checkbox"/> Tool	<input type="checkbox"/> Lighting	<input type="checkbox"/> Training
<input type="checkbox"/> Adjustability	<input type="checkbox"/> Mechanical Assist	<input type="checkbox"/> HVAC	<input type="checkbox"/> Policy
<input type="checkbox"/> Work Height	<input type="checkbox"/> Job Rotation	<input type="checkbox"/> Mat/Insoles	<input type="checkbox"/> Procedure
<input type="checkbox"/> Tilt/Re-orient	<input type="checkbox"/> Job Expansion	<input type="checkbox"/> PPE	<input type="checkbox"/> Reward
<input type="checkbox"/> Organize	<input type="checkbox"/> Change Pace	<input type="checkbox"/> Rest Breaks	<input type="checkbox"/> Shut Down
<input type="checkbox"/> Chair	<input type="checkbox"/> Get Help	<input type="checkbox"/> Mini-Breaks	<input type="checkbox"/> Further Study
<input type="checkbox"/> Housekeeping	<input type="checkbox"/> Automate	<input type="checkbox"/> Fitness	<input type="checkbox"/> Other

Describe Recommendations

4. Cost Analysis/Justification (Prioritize)

5. Action Plan (Who, What, When)

Appendix 23-B
Checklist for Evaluation of Ergonomic Stress in Industrial Shops

	<u>Yes</u>	<u>No</u>	<u>N/A</u>
1. Physical Stress:			
1.1 Does the job require contact of fingers or wrist with sharp edges?	_____	_____	_____
1.2 Do hand tools or process equipment vibrate the worker's hands, arms, or whole body?	_____	_____	_____
2. Force:			
2.1 Does the job require more than 10 pounds of force?	_____	_____	_____
2.2 Does the job require using a pinch grip (between thumb and finger)?	_____	_____	_____
2.3 Are gloves used, increasing the force needed for motion of the fingers?	_____	_____	_____
2.4 Does the job require frequent heavy lifting (> 18 kg or 40 lb, 2 hours per day)?	_____	_____	_____
2.5 Does the job require occasional very heavy lifting (> 23 kg or 50 lb)?	_____	_____	_____
2.6 Does the job require handling items that are difficult to grasp?	_____	_____	_____
3. Posture:			
3.1 Does the job require flexion or extension (bending up or down) of the wrist?	_____	_____	_____
3.2 Does the job require deviating the wrist side to side (ulnar or radial deviation)?	_____	_____	_____
3.3 Is the worker seated while performing the job?	_____	_____	_____
3.4 Does the job require "clothes wringing" motion?	_____	_____	_____
3.5 Does the job require extended reaches, beyond normal arm reach?	_____	_____	_____
3.6 Does the job require awkward lifts or carries that are near the floor, above the shoulders, or far in front of the body?	_____	_____	_____
3.7 Does the job require exertion of pushing, pulling, lifting, or lowering forces in awkward positions to the side, overhead, or at extended reaches?	_____	_____	_____
3.8 Do workers sit on the front edge of their chairs?	_____	_____	_____
3.9 Is the worker required to maintain the same posture, either sitting or standing, all of the time?	_____	_____	_____

	<u>Yes</u>	<u>No</u>	<u>N/A</u>
4. Workstation hardware:			
4.1 Is the orientation of the work surface non-adjustable?	_____	_____	_____
4.2 Does the work surface appear to be too high or too low for many operators?	_____	_____	_____
4.3 Is the location of the tool non-adjustable?	_____	_____	_____
4.4 Does the job require handling oversized objects that require two-person lifting?	_____	_____	_____
4.5 Is there an absence of material handling aids, such as air hoists and scissors tables?	_____	_____	_____
4.6 Do workers attempt to modify their chairs or work surfaces by adding cushions or pads?	_____	_____	_____
5. Repetitiveness:			
5.1 Does the job require that one motion pattern be repeated at a high frequency?	_____	_____	_____
5.2 Is the cycle time for repetitive operations less than 30 seconds?	_____	_____	_____
5.3 Is the work pace rapid and not under the operator's control?	_____	_____	_____
6. Tool design:			
6.1 Is the handle too large for the thumb and finger to slightly overlap around a closed grip?	_____	_____	_____
6.2 Is the span of the tool's handle less than 5 cm (2 inches)?	_____	_____	_____
6.3 Is the handle of the tool made of metal?	_____	_____	_____
6.4 Is the weight of the tool greater than 10 lbs?	_____	_____	_____
6.5 Are heavy tools lacking devices to suspend some of their weight?	_____	_____	_____
6.6 Does use of the tool require flexion or extension of the wrist (bending up or down)?	_____	_____	_____
6.7 Does the tool require ulnar or radial deviation of the wrist (bending to either side)?	_____	_____	_____
7. Work environment:			
7.1 Are housekeeping practices poor, e.g., aisles cluttered, waste on the floor?	_____	_____	_____
7.2 Are floors uneven or slippery?	_____	_____	_____
7.3 Does the job require frequent (daily) stair or ladder climbing?	_____	_____	_____
7.4 Do the work tasks contain significant visual components, requiring good lighting?	_____	_____	_____
7.5 Does the worker's eye have to move periodically from dark to light areas?	_____	_____	_____

7.6 Is the air temperature uncomfortably hot or cold? _____
Score (count all "yes" answers) _____

Comments: _____

Prepared by: _____ Date: _____

Shop/Task Identification: _____

Operator's Name: _____

Evaluation: When a group of workstations are evaluated using this checklist by the same individual, the workstations with the higher scores should be the ones most likely to cause ergonomic stress. It is not necessary for each workstation to achieve a "zero," or perfect score, on this checklist. Common sense should be used to determine where modifications are necessary, reasonable, and feasible.

**Checklist for Evaluation of Ergonomic Stress at Workstations
Equipped with Video Display Terminals**

	<u>Yes</u>	<u>No</u>
1. VDT stations are arranged so that lighting does not reflect directly off the screen.	_____	_____
2. The seat and backrest of the chair support comfortable posture permitting occasional variation in the sitting position.	_____	_____
3. Seat height is adjustable so that the entire sole of the foot rests on the floor or footrest, and the back of the knee is slightly higher than the seat of the chair.	_____	_____
4. Backrest height is adjustable.	_____	_____
5. Backrest angle is adjustable.	_____	_____
6. Footrest provided if desired by individual.	_____	_____
7. The height of the surface on which the keyboard rests is adjustable, allowing the worker's forearms, with fingers resting on the keyboard, to be nearly horizontal or inclined slightly upward.	_____	_____
8. The workstation is adjusted so that the wrist is in a straight line, i.e., not bent up or down.	_____	_____
9. The topmost line of the screen is slightly below eye level.	_____	_____
10. Screen position can be tilted.	_____	_____
11. Document holder is positioned at the same height and at the same distance from the viewer as the screen.	_____	_____
12. Work surface is large enough to hold all needed reference material (at least 35 inches wide).	_____	_____
13. Paper can be easily and conveniently loaded into printers without the need for lifting heavy boxes in awkward postures.	_____	_____
14. Screen has color, brightness, and contrast satisfactory with the operator.	_____	_____
15. The illumination level at the VDT station is between 45 and 70 foot candles (500 and 700 lux).	_____	_____

- | | <u>Yes</u> | <u>No</u> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|
| 16. Characters on the screen are clear and free of flicker or jitter. | _____ | _____ |
| 17. There is adequate room under the work table to permit movement of operator's legs and a foot rest where necessary. | _____ | _____ |
| 18. Task schedules allow the operator to perform duties not requiring use of the VDT at least 15 minutes during each 2-hour period. | _____ | _____ |
| 19. Are all adjustments easy to make with a single lever or are controls known? (Equipment that is difficult to adjust will probably not be adjusted properly.) | _____ | _____ |

Score (count all "No" answers) _____

Comments: _____

Prepared by: _____ Date: _____

Shop/Task Identification: _____

Operator's Name: _____

Evaluation: When a group of workstations are evaluated by the same evaluator, the higher scores should indicate which workstations are more likely to cause ergonomic stress. It is not necessary for each workstation to achieve a perfect score on this checklist. Common sense should be used to determine whether modifications to workstations are necessary, reasonable, and feasible.

Appendix 23-C

Model Specification for an Ergonomic Job Hazard Analysis

Objective: Evaluate work positions that have been identified as putting workers at high risk of developing cumulative trauma disorders; verify low risk factors of light duty or restricted activity work positions; or to determine if risk factors for a work position have been reduced to the extent feasible.

Work Scope: Evaluate the following work positions:

[list to be inserted at time of assignment]

Qualifications: The requested analysis shall be performed by or under the direct supervision of a person who possesses a recognized degree or professional credentials in ergonomics or a closely allied field, e.g., human factors engineering, and who has demonstrated, through knowledge and experience, the ability to identify and recommend effective means of correction for ergonomic hazards in the work place.

Technical Requirements:

1. Quantitatively characterize risk factors of posture, repetitiveness, force, and tool design.

a. Posture should be measured in degrees about the three axes in the shoulder, two axes in the elbow, and two axes in the wrist. Anthropometric measurements should be made of the worker who is performing the job, or ranges indicated for the worker for whom the job is designed.

b. For upper extremities, three quantitative measurements of repetitiveness are the total hand manipulations per

cycle, the total per workshift, and the cycle time.

c. Force measurements may be estimated as an average effort, and a peak force.

d. Tool vibration should be measured at a point close to where the vibration enters the hand, in three mutually-orthogonal directions over a range of frequencies from 8 to 1500 Hertz. Measurement results should be expressed in frequency-weighted acceleration units (in/sec²) root mean square (rms). If results are expressed in decibels, the decibel reference level and the method for converting to acceleration units must be stated to allow comparison with American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values.

e. The dimensions of the workstation, tools, and personal protective equipment should be noted for each job hazard analysis. The physical demands and requirements of the jobs should be listed with the analysis.

f. For manual materials handling, the maximum weightlifting values should

15 January 1999

be calculated in newtons (see reference 23-6).

2. Obtain slow-motion videotape or equivalent visual records of workers performing their routine job tasks and analyze them to determine the efficacy of the relationship of the worker to the work position.

3. Systematically describe how, when, and where postural stressors, e.g., flexion, extension, and deviation, occur in the sequence of actions required to complete each task.

4. Recommend engineering and work practice control methods that would reduce or eliminate risk factors.

5. Devise an evaluation method that can be used to measure the effectiveness of workplace modifications. For example, a methodology for interviewing workers to determine the extent and severity of symptoms related to CTD before and after work-place modifications could be proposed.

Appendix 23-D

Ergonomic Considerations for Shift Workers

A. Nature of Occupational Hazard

Shift work is a risk factor for several medical disorders, poor performance, and decreased vigilance in the job. It presents these problems because of its conflict with the normal human biological rhythms, particularly the sleep/wake rhythm and the temperature rhythm, which direct the body to sleep at night.

The problem with night work (and transmeridian jet travel) is that the normal time cues are shifted faster than the human circadian rhythms can adjust. For example, it takes at least 2 days for the sleep/wake cycle to adjust to a 6-hour transmeridian flight. More time is required for body temperature and performance rhythms to adjust. Two to 3 weeks are required for complete adjustment of the temperature rhythm to a complete day-night reversal (a 12-hour time shift, which is typical for night workers). Some individuals never completely adjust to time shifts of this magnitude. Because different biological rhythms adjust at different rates, not only does the person become desynchronized with respect to external time cues, but individual rhythms no longer have a normal phase relationship.

The most frequent problem for night workers, experienced by at least 60 percent of these workers, is chronic sleep deprivation due to not only fewer total hours of sleep, but disrupted sleep as well. Such sleep deprivation in night workers can be severe. Night work has also been shown to be disruptive with respect to family and social interactions. Shiftworkers are at higher risk

of psychosocial problems as well as family problems, including divorce.

Persons with a history of rigid sleep requirements, strong "morning types," and older workers (over 45) are more apt to have difficulty adjusting to night work. Five to 20 percent of night workers will suffer from shift maladaptation syndrome, which can only be treated by removal from the night shift. Individuals with excessive family responsibilities will be at high risk of significant chronic sleep deprivation, as will those with long commuting times to and from work.

B. Shift Workers Scheduling Guidelines

Supervisors who prepare schedules for night shifts must consider the potential for scheduling practices to affect the ability of individuals to perform assigned tasks safely.

NOTE:

Unless prescribed by current labor contracts, schedules must be rotated in the forward (clockwise) direction (i.e., day to swing to graveyard).

This direction is best because the human clock runs slow with respect to the 24- hour solar day and, therefore, adjusts faster to a phase delay than to a phase advance. The following additional guidelines regarding scheduling of night workers (including workers on rotating schedules that include night work) are recommended for consideration when preparing schedules, but are not mandatory:

(1) At least 48 hours off should follow the night shift rotation. If at all possible, when several nights are worked in a row, the shift rotation should be followed by 72 hours off.

(2) In situations involving rotating shifts, the number of night shifts worked in a row should be limited to no more than four or five, if at all possible.

(3) Overtime is scheduled at management's prerogative, although sometimes constrained by labor contract agreements. Supervisors should be aware that scheduling overtime hours during the time of day when performance is poorest and asking workers who are already at high risk for sleep deprivation to work more than 8 hours is unwise, both from a medical and a safety perspective.

(4) Worker preferences should be considered in schedule planning. It should not be assumed that all groups of workers will prefer the same schedule. Family obligations, commuting times, etc. vary. Satisfaction with the work schedule is associated with fewer work-related health complaints and with lower absenteeism rates.

C. Medical Surveillance for Shift Workers

Being assigned night shift work, by itself, does not obligate an employee to undergo a medical evaluation. Where medical evaluations are otherwise required (i.e., for positions covered by medical standards, physical requirements, or medical surveillance programs) the requirement to work night shifts should be indicated by the appointing officer on the SF-78 by circling item B-28, "Protracted or irregular hours of work," to alert the examining physician to evaluate the individual's fitness to work night shifts and/or recommend appropriate restrictions.

Supervisors may request medical qualification information from workers who demonstrate persistent performance problems and/or increased absenteeism after beginning night work. Even workers who have been able to tolerate night work for years may begin to show signs and symptoms of shift work intolerance with increasing age. Workers who claim to be unable to tolerate night work should not be forced to continue working the shift without medical clearance to do so.

Pre-employment evaluation of workers who will be involved in night work and medical surveillance of employees doing shift work should give attention to the following medical conditions that may impair an individual's ability to perform assigned tasks safely or be aggravated by shift work schedules.

a. Diabetes mellitus, epilepsy, being at high risk of cardiovascular disease, asthma, peptic ulcer disease, irritable bowel syndrome, or use of any medication with circadian variation in effectiveness. The examining physician must determine when such medical conditions are

severe enough to warrant medical disqualification for night work.

b. When applying this portion of the instruction, supervisors are cautioned to consult Federal Personnel Manual (FPM) chapter 339 governing medical qualification determinations.