

**UNITED STATES AIR FORCE
ARMSTRONG LABORATORY**

**Preventing Work-Related
Musculoskeletal Illnesses Through
Ergonomics: The Air Force PREMIER
Program Volume 3A: Level I
Ergonomics Methodology Guide For
Administrative Work Areas**

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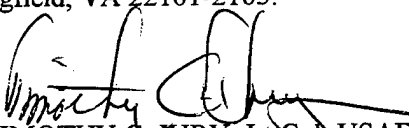
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ABOUT THIS GUIDE

This Level 1 Ergonomics Methodology Guide (Guide) for Administrative Work Areas is designed to be read and implemented by Bioenvironmental Engineers and Bioenvironmental Technicians. The purpose of the Guide is to enable the BEF to identify risk factors, to prioritize problems to select realistic controls, and to facilitate modifications so the Air Force can maintain readiness by improving employee performance and well-being.

This Guide is organized for ease of use. Initially, users will need to rely on all the parts in order to complete the process as it is designed. After they are familiar with the process, they can excerpt only those sections that they need. For example, the Guide is organized so that the parts needed for data collection can be extracted for use in the field. Other parts used in problem prioritization, solution selection, etc., may be left in the BEF shop for later use.

The Guide has **three chapters and six appendices**.

Chapter 1: Introduction provides users and other readers with the background information they need to understand the process. It provides the following information:

- the objectives of the Guide
- the role of this Guide in the overall ergonomics efforts of the Air Force. In particular, it describes the circumstances in which the Guide is to be used.
- the criteria and processes that were used to develop the Guide.

Chapter 2 : General Background on Ergonomics provides a brief explanation of the issues that the Guide is intended to address. Although this chapter will be particularly helpful to users who may have limited knowledge of ergonomics, it can serve as a refresher to those who are already knowledgeable. The chapter also provides insight into the intended outcomes of the process and provides the framework for the more detailed ergonomics information included in the other sections.

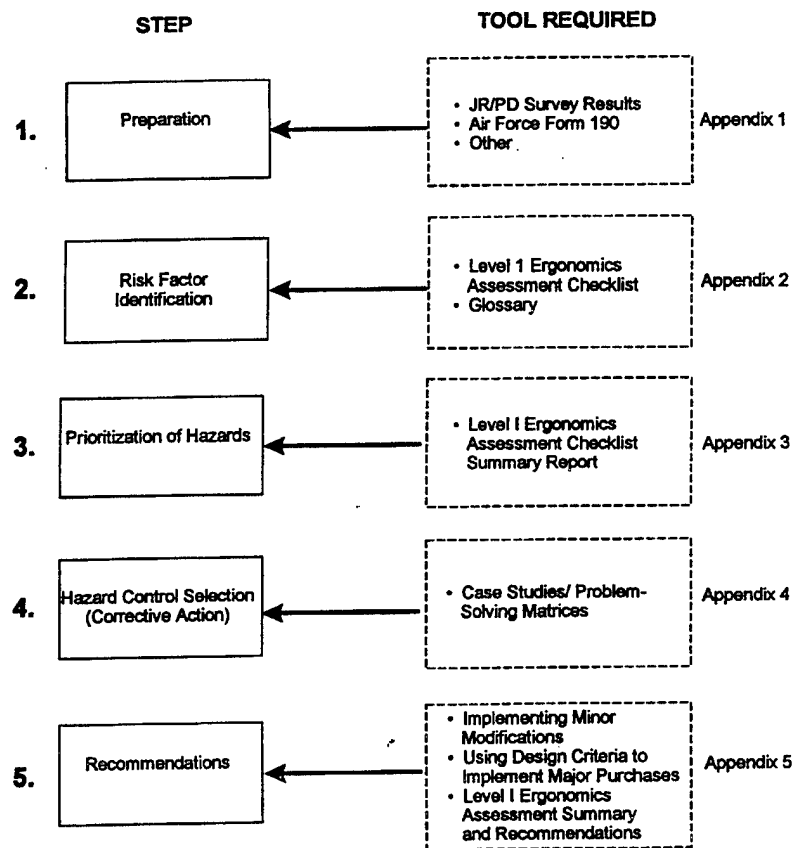
Chapter 3: User's Guide is the heart of the Guide. This section will be used to implement the Level I Ergonomics Assessment and Problem-Solving Methodology. It is designed to provide step-by-step instructions to a BEF technician with two to three years of experience. The chapter details the *Five Step Process* and refers the user to *Appendices 1-5*, which provide the tools required to complete each step in the Methodology and examples of results obtained at each step.

The Five Steps and the Tools Required are:

- Step 1. Preparation
- Step 2. Risk Factor Identification
- Step 3. Prioritization of Hazards
- Step 4. Hazard Control
- Step 5. Recommendations

The Level I Ergonomics Assessment and Problem-Solving Methodology for Administrative Work Areas is shown in Figure 1.

Figure 1
Level 1 Assessment Process



Appendices

The Appendices are an integral part of the Guide and are designed for quick reference. Each Appendix relates to a Step in the process.

Appendix 1: Preparation

This appendix provides users with a sample summary from the JR/PD Survey, with an Air Force Form 190, and other information that they need to begin the process.

Appendix 2: Risk Factor Identification

This appendix provides users with a sample *Level 1 Ergonomics Assessment Checklist* to use as a guide in completing the checklist they are using on a job. Most importantly, it includes the Glossary which defines each checklist question in detail and provides guidelines on what to look for when are observing the jobs.

Appendix 3: Prioritization of Hazards

This appendix provides users with a sample of a completed *Scoring Summary* so that they know how to score the jobs on which they have completed a checklist.

Appendix 4 : Hazard Control Selection

This appendix is the focal point for identifying the causes of ergonomics risk factors and for selecting corrective actions. *Case Studies* for 11 typical tasks in Administrative Work Areas (computer use, filing, etc.) are included here. Case Study problem-solving matrices are organized so that users simply look for the body region and risk factor identified in the Level I Checklist in order to pattern match the cause with corrective actions, risk factor by risk factor. Once users become familiar with the process, this is probably the only Appendix that will be needed for subsequent assessments.

Appendix 5: Recommendations

This appendix provides an example of a completed *Summary/Recommendations* form so that the user has guidance when completing the Step 5. It also includes the "Implementing Minor Modifications" section, which provides further detail on selected Corrective Actions referred to in the Case Studies.

A section on "Using Design Criteria to Implement Major Purchases" is included to provide users involved in the selection of furniture or accessories, with the ergonomics criteria upon which to evaluate products. The Evaluation Forms provided can be sent to prospective vendors to help identify which products meet the criteria.

Appendix 6: Blank Forms

This section simply provides the blank forms that users can copy in order to apply the Methodology.

Appendix 7: References/Bibliography

References noted in the Guide and the bibliography for this effort are found in this section.

This Guide enables users to identify risk factors and recommend corrective actions on most of the jobs and tasks they will observe with the assurance that in most cases, a professional ergonomist would have made the same decisions. It will also let them know when they should obtain assistance from Armstrong Laboratory (AL/OEMO) or other ergonomists in cases when the pattern-matching process may not adequately address the problem and a Level 2 Ergonomics Assessment is needed.

In any case, this Guide provides the Air Force with the Methodology it needs to identify and abate ergonomics hazards in a wide range of Administrative jobs.

A Research Report describing the development and testing of this Guide is available. Please contact Armstrong Laboratory (AL/OEMO) for further information.

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFMC	Air Force Materiel Command
AFOSH	Air Force Occupational Safety and Health
AL/OEMO	Armstrong Laboratory/Occupational Medicine Division
BEF	Bioenvironmental Engineering Flight
CAD	Computer Aided Drafting
CTD	Cumulative Trauma Disorder
EPRA	Ergonomics Problem Area
EWG	Ergonomics Working Group
JR/PD	Job Requirements/Physical Demands (Survey)
PEPA	Potential Ergonomics Problem Area
PHF	Public Health Flight
RM-ANOVA	Repeated Measures Analysis of Variance
RSI	Repetitive Strain Injury
USAF	United States Air Force
VDT	Video Display Terminal
WMD	Work-Related Musculoskeletal Disorders
WPAFB	Wright-Patterson Air Force Base

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1.0 INTRODUCTION

1.1 PROGRAM OBJECTIVES

The U.S. Air Force has sponsored the development of standard ergonomics assessment methodology guides and management tools which will be integrated into the AFOSH Program. The methodologies and tools will be used as a means to minimize or eliminate work-related musculoskeletal disorders (WMDs) associated with routine exposure to ergonomics risk factors at Air Force installations.

The basic elements of an installation ergonomics program include: Potential Ergonomics Problem Area (PEPA) designation, Ergonomics Problem Area (EPRA) designation and control, work area analysis, medical management, and training and education. Both qualitative (PEPA) and quantitative (EPRA) screening techniques are used in sequential fashion to identify employees at risk. The flow chart in Figure 1.1 describes the ergonomics program process.

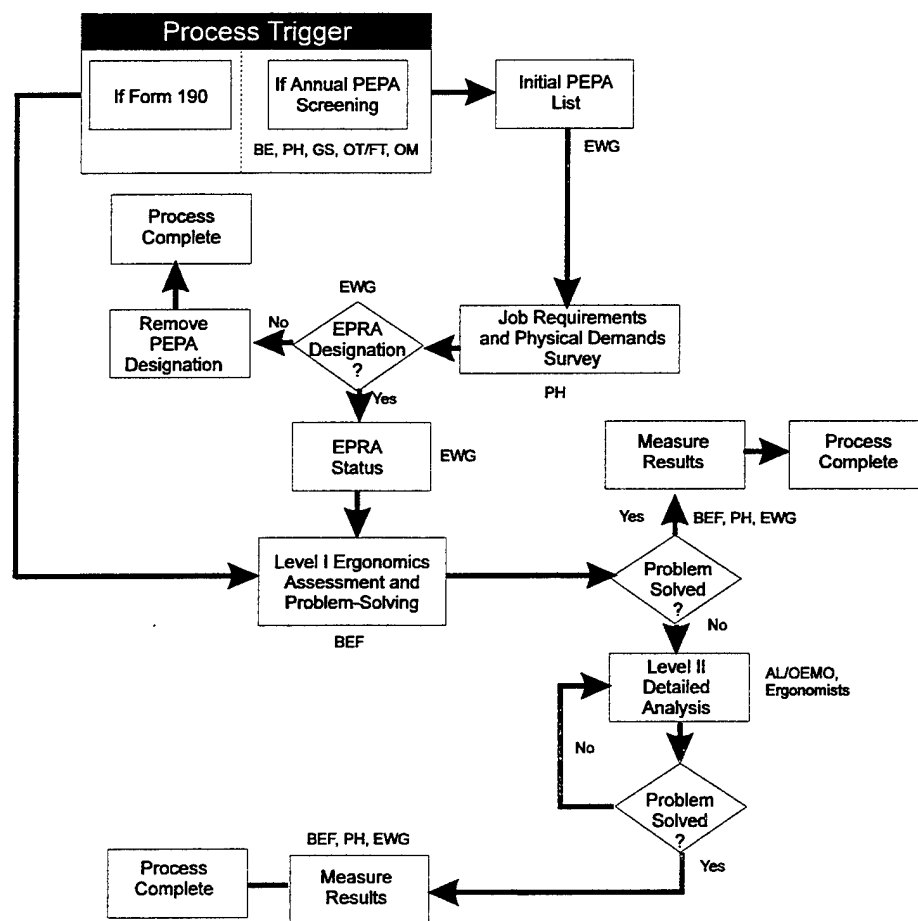


Figure 1.1
Ergonomics Problem-Solving Process

1.2

DEVELOPMENT OF CRITERIA

The Level I Ergonomics Assessment and Problem-Solving Methodology Guide for Maintenance and Inspection Work Areas (hereafter referred to as the Guide) details a process that can be applied to the full variety of Air Force maintenance and inspection jobs.

The Guide was designed to enable a Bioenvironmental Engineer or Technician with 2-3 years of experience to conduct aggressive task-based problem-solving efforts in an Ergonomics Problem Area (EPRA). The Guide is designed such that the process can be completed as follow-up to the Job Requirements and Physical Demands Survey (hereafter referred to as the JR/PD Survey) completed by PHF or in response to an Air Force Form 190 investigation.

The Guide was developed in accordance with criteria established by the United States Air Force (USAF). This criteria was that the Guide must be designed to enable users, primarily through visual observations and employee/supervisor interviews, to:

- identify potentially hazardous tasks within a shop and job;
- determine if the content of the job and task(s) meet established ergonomics (risk factor exposure) criteria;
- determine which type(s) of additional (Level II) analyses may be used if further quantification of ergonomics hazards is required; and
- choose from a menu of control options (both short- and long-term) which when implemented, will minimize the risk of musculoskeletal disorders by reducing the hazards identified within the job and tasks.

The Guide must enable the user to complete data collection and analysis of a administrative work area in 1-2 hours depending on the number of tasks evaluated. Hazard Control selection and development of a summary report (recommendations) should require 1-2 hours.

The Guide is to include case studies for typical administrative tasks. The case studies serve as the basis for the pattern-matching process that will be used to "match" the hazards identified in the tasks with controls that will reduce employee exposure to accordance those hazards.

The Guide is to identify metrics which will be used to judge the impact of ergonomics improvements on employee health, safety, and performance (e.g., quality, productivity).

In addition, the Guide will incorporate information and lessons learned from the JR/PD Survey in order provide an integrated ergonomics analysis and problem-solving process for the Air Force.

1.3 DEVELOPMENT PROCESS

The Guide design is the result of a development and testing process that benefited from the support and cooperation of Air Force personnel at several AFMC locations:

- Armstrong Laboratory (AL/OEMO), Brooks AFB, Texas
- Wright-Patterson AFB, Ohio (WPAFB)
- Eglin AFB, Florida
- Tinker AFB, OklahomaKelly AFB, Texas

1.3.1 Initial Efforts. The development of this guide began with a review of the scientific literature. The purpose of the review was to compile information on ergonomics analysis tools that would be relevant to the development effort. The goal was to identify methods which would require minimum expertise to complete balancing maximum benefit for the USAF. The literature review indicated that there was a lack of validated ergonomics assessment/problem-solving methodologies which satisfied the criteria established by the USAF. However, several tools were identified which served as the basis for individual components of the Guide.

Development continued with site visits to selected USAF installations; Wright-Patterson AFB, Eglin AFB, and Tinker AFB. The purpose of the site visits was to collect data (e.g., videotapes, digital photographs, workstation measurements, employee interview results, etc.) on the job types that would be used for developing Case Study Problem-Solving Matrices. The job types were selected by the Air Force and are consistent with "Types of Work" listed in Section III of the JR/PD Survey which will be used by PHF. Many of the jobs observed during the 52 task-based Case Study Problem-Solving Matrices, listed in Table 1.1, are based on a compilation of the most common elements found in one of more jobs at one of more of the bases.

Table 1.1
Administrative Case Study Problem-Solving Matrices in the Guide

Case Study #	Case Study Title	Job/Task Name and Area	Base
1	Using a Computer Word Processing - keying/typing - mousing	- Contract Specialist - PKW Base Contracting - Illustrator - Photographic	- WPAFB - WPAFB
2	Writing/Illustrating	Contracting Specialist - Contracts	WPAFB
3	Stapling	NCOIC Guards/Reserves - Finance	WPAFB
4	Monitoring Visual Displays (Vigilance)	Air Traffic Control Center	Patrick AFB (AFSPC)
5	Calling (Telephone Use)	Contracting Officer - Contracting	WPAFB
6	Copying/Sorting	Systems Analyst Specialist - Computer	WPAFB
7	CAD System Use (Drafting)	CAD Operator - Weather Center	Eglin AFB
8	Filing/General Administrative	Administrative - Public Health	Eglin AFB
9	Use of Calculator/Numeric Key Pad	Travel Computation PCS - Finance	WPAFB
10	Lifting/Pushing/Pulling	Hospital Records Filing - Hospital	Eglin AFB
11	Microscope Work	Microscope Work - Cytology	WPAFB

Based on the results of the literature review and the site visits, the following components of the Guide were developed:

1. User's instructions;
2. A Level I Ergonomics Assessment Checklist;
3. Checklist Glossary;
4. An Ergonomic Summary Report (scoring sheet, case study selection key, and control summary list); and
5. Case Study Problem Solving Matrices (Corrective Actions).

These components were used to test and validate the design of the Guide.

1.3.2 Testing and Validation. The purpose of testing and validation was to establish strengths and limitations of the initial Guide and to identify the need for changes based on quantitative information. The testing and validation was conducted in two phases: alpha testing and beta testing.

Five ADL/TJI ergonomists not directly involved in Guide development participated in the **alpha** testing. The ergonomists commented on the usability of the Guide tools and user's instructions. A second draft of each of the Guide components was developed to reflect those comments. After alpha testing was completed, a consensus score for several measures (e.g., each Job and Environmental Factor question), from the Guide was developed to serve as a testing standard during beta testing.

Ten Air Force personnel were selected to participate in a **beta** test at Hill AFB. These personnel were to be selected to "match" the targeted end-user population: BEF Technician with 2-3 years of experience. The ergonomist/facilitator provided a two-hour briefing using a sample job to demonstrate the Guide, use of the tools, and process for completing the assessment and pattern-matching activity. The actual testing process and materials provided were the same as for the alpha test (with the appropriate revisions). Information on usability was obtained during an out-briefing and additional refinements were made to the Guide to improve usability.

For each phase, the results were tested for Usability, Reliability, Sensitivity, and Validity. Usability testing was performed to ensure that the users would be able to apply the Guide as intended. Reliability testing was performed to determine how consistently that application of the Guide yielded the same results. Sensitivity testing was performed to determine if the Level I Assessment can tell the difference between actual risk levels in a job. And finally, validity testing was conducted to measure how closely the results from experienced ergonomists matched the results obtained by Air Force personnel.

Those who are interested in a detailed description of the testing and validation process and results are directed to contract Armstrong Laboratory (AL/OEMO) for further information.

1.4 FREQUENTLY ASKED QUESTIONS ON THE METHODOLOGY GUIDE

Typical questions and answers about the Guide are provided in Table 1.2.

Table 1.2
Typical Questions and Answers About the Guide

Question	Answer
What is the Guide used for?	The Guide enables Bioenvironmental Engineers and Technicians to conduct aggressive, task-based problem-solving in an Ergonomics Problem Area (EPRA).
What kind of experience or ergonomics knowledge is required in order to use the Guide effectively?	The Guide was designed for a BEF Technician with 2-3 years of technical experience. Although some prior knowledge of ergonomics is a benefit, ergonomics "expertise" is not required for successful application of the Guide.
Is the Guide to be used on all jobs throughout the base?	No. The intent is to use the Guide only in EPRA designated shops EPRA status is designated by the installation Ergonomics Working Group (EWG) based on the results of the JR/PD Survey administered by Public Health Flight (PHF).
When, specifically, is the Guide to be used?	The Guide was designed for use in two primary situations: • as follow-up to the JR/PD Survey if a shop has been classified as an EPRA; or • in response to an AF Form 190 investigation (completed by PHF).
How will I learn how to apply the Guide effectively?	A User's Guide provides a good foundation on which to begin. The Air Force recommends that the user participate in a 2-3 hour briefing in which a trained specialist will demonstrate use of the Guide.

Table 1.2
Typical Questions and Answers (Cont'd)

Question	Answer
How is the Guide organized?	You are reading the Introduction now. Chapter 2 provides basic background information on ergonomics. Chapter 3 is the actual User's Guide. Chapter 3 takes you through a 5-step process for completing the Level I Ergonomics Assessment and Problem-Solving Methodology: - Step 1 - Preparation - Step 2 - Risk Factor Identification - Step 3 - Prioritization of Hazards - Step 4 - Hazard Control Selection - Step 5 - Recommendations Also included in the Appendices are examples of completed forms so you can see what the results of your work should look like at each step.
What is included in Step 1 - Preparation?	In Step 1, the Guide explains in detail, when to use the Level I Assessment and Problem-Solving Process, logistics (e.g., forms), how to interpret and use data from the completed JR/PD Survey and/or an AF Form 190 for selecting which jobs to focus on during your investigation.
What is included in Step 2 - Risk Factor Identification?	In Step 2, you will be introduced to the Level I Ergonomics Assessment Checklist. It is a practical, observation-based Checklist which does not require the use of gauges or specialized ergonomics analysis equipment. You complete the Checklist by observing the job tasks and talking with the employee.
What is the significance of the Checklist?	The Checklist helps you identify ergonomics risk factors.
Who will interpret the results?	The same person who completed the Checklist will interpret the results. The Checklist results are a direct lead-in to control identification.
What is included in Step 3 - Prioritization of Hazards?	In Step 3, you will be shown how to score the Checklist. The scoring process tells you: • if there is significant concern in the overall job; • what task(s) is the primary source of exposure to ergonomics risk factors; and • what part(s) of the body should be targeted when identifying controls.
How long does it take to complete Steps 2 and 3?	In previous trials BEF Technicians with minimal to no prior experience with ergonomics analysis completed the process in 15 to 45 minutes.

Table 1.2
Typical Questions and Answers (Cont'd)

Question	Answer
What is included in Step 4 - Hazard Control Selection?	In Step 4, you will learn about the 11 Case Study Problem-Solving Matrices for maintenance and inspection work. The case studies provide you with a head start on identifying controls or corrective actions which can be implemented to reduce employee exposure to the most common ergonomics risk factors found in administrative tasks. Two categories of controls are provided; modifications and adjustments, and major changes. Approximately 75 percent of the controls can be implemented for little or now cost. For selected controls - one's that you may need some additional detail to implement correctly - you will be directed to the sections, "Implementing Modifications and Adjustments" or "Using Design Criteria to Implement Major Changes" in Appendix 5.
Will we use all of the case studies for every job?	No. After you have identified the task(s) that exposes the employee to the most significant levels of ergonomics risk factors, the instructions in Step 4 will explain how to select the case study or studies that "match" the task(s).
How exactly is a case study used?	After the appropriate case study is identified, you read through the Case Study Problem-Solving Matrix and "match" the risk factors identified with the Checklist to controls that can be implemented to reduce or eliminate exposure to the risk factor.
What is included in Step 5 - Recommendations?	From Step 4 you will have identified a number of controls that could be implemented. In Step 5, the Guide describes the process for developing the final summary report and final list of recommendations which will be provided to the shop supervisor and kept on file in Bioenvironmental Engineering. The Level I Ergonomics Assessment Summary and Recommendations form will enable you to communicate the most important information to the supervisor and establish the basis for implementing controls, planning follow-up, and measuring the results of ergonomics improvements.

Table 1.2
Typical Questions and Answers (Cont'd)

Question	Answer
Who gets the completed Level I Ergonomics Assessment Summary and Recommendations form?	One copy of the report is to be kept in the case file for the work center. A copy should also go to the work center supervisor who will be responsible for following-up on the recommendations. Other parties may also be provided with a copy of the report at the discretion of Bioenvironmental Engineering. It is highly recommended that you discuss the report with the work center supervisor and the employee(s) in person in order to promote a fast and effective implementation.
How long does it take to complete Steps 4 and 5?	In previous tests, BEF Technicians required under 30 minutes to complete the pattern matching process and select controls (corrective actions). Completion of the Level I Ergonomics Assessment Summary and Recommendations form is not expected to add much additional time to the process. It is expected that, even for the most complex administrative jobs, completion of Steps 4 and 5 should take no more than one hour.
Can the results and recommendations for ergonomic improvement be applied throughout the shop?	Even though the Methodology may have been applied to only one job type in a work area (e.g., contract specialist), the results may indicate, for example, that all employees who perform the contract specialist job, and who typically spend over 4 hours per day on the phone, may benefit from use of a headset. In other words, the results obtained from applying the Methodology to one "representative" workstation for a particular job type, may be applicable to all other workstations for that job type.

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2.0 GENERAL BACKGROUND ON ERGONOMICS

The information in this chapter has been assembled to provide users with limited experience with ergonomics a concise introduction to the science of ergonomics and how employees may be impacted when ergonomics is not adequately incorporated into job or workplace design. Users who have more experience may wish to skip this chapter or scan the pages as a refresher.

2.1 PURPOSE OF ERGONOMICS

Ergonomics is the science that addresses workers' job performance and well-being in relation to their job tasks, tool, equipment, and environment. Good ergonomics means designing tasks and the workplace to fit the workers - instead of the other way around.

The sciences on which the practice of ergonomics is based include: biomechanics, psychology, physiology, anthropometry, engineering, and kinesiology. The first three sciences help to define worker capabilities and limitations (e.g., how much hand strength the average male or female possesses). The other three sciences provide guidelines for designing jobs and workplaces to more closely reflect those capabilities and limitations.

The purpose of applying ergonomics in the workplace is to provide a work environment which maximizes the worker's performance while minimizing the risk of illness and injury to the musculoskeletal and visual systems.

2.2 MUSCULOSKELETAL ISSUES

Numerous studies have been conducted to determine the frequency and severity of musculoskeletal complaints among Video Display Terminal (VDT) operators. In a University of Wisconsin study, 35 percent of the VDT operators reported that they experienced frequent or constant back discomfort. In a large scale NIOSH study, 64 percent of the operators reported neck discomfort, 62 percent reported upper back discomfort and 71 percent reported lower back discomfort with a frequency of *a few times a week to every day*.

Studies differ in their outcomes regarding the question of whether VDT operators experience these complaints more often than other clerical workers. It is clear, however, that the introduction of VDTs presents new workstation design requirements. Research indicates that proper workstation design and job design can alleviate most operator complaints of musculoskeletal aches and pains. A number of general guidelines for workstation design have been developed to assist in making these changes in the VDT workplace.

2.2.1 Work-Related Musculoskeletal Disorders and Risk Factors. Many of the work-related musculoskeletal disorders (WMDs) are a class of disorders which are also referred to as cumulative trauma disorders (CTDs) or repetitive strain injuries (RSIs).

This type of disorder develops due to an accumulation of stress or damage to the body over time. The body has great recuperative powers if provided with the opportunity to repair itself. However, when job demands are high (e.g., repeated use of awkward positions combined with forceful exertions or high effort) and the recovery time is insufficient, there is an increased likelihood that accumulated damage will lead to a disorder. Figure 2.1 illustrates this relationship.

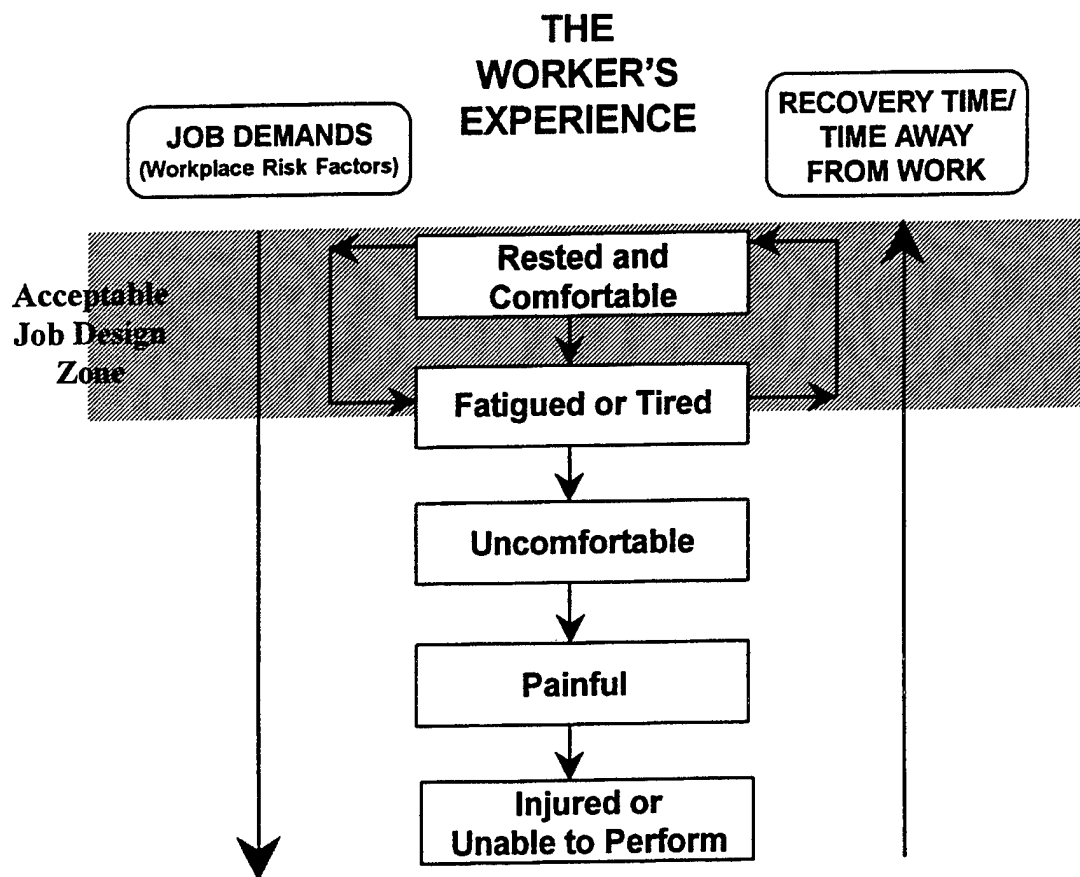


**Figure 2.1
The Worker's Experience**

The most common type of musculoskeletal discomfort in administrative work is soreness or aching, usually in the low back and neck. Aching and abnormal sensations such as numbness or tingling in the extremities may also be reported by administrative workers, although less frequently. The following sections describe each of the major body regions, the most common WMDs, and the risk factors which impact the body region.

2.2.1.1 Shoulder/Neck

2.2.1.1.1 Disorders. The following are the most common shoulder and neck disorders found in the administrative setting as shown in Figure 2.2.

- **Bursitis** - an inflammation of the bursa sac (fluid-filled cushion) in the shoulder joint.
- **Tendonitis** - an inflammation of the muscle tendon, in various regions of the body including the upper arm/shoulder region.
- **Rotator Cuff Tendonitis** - an inflammation of the tendons in the shoulder.
- **Thoracic Outlet Syndrome** - characterized by a compression of the nerves and blood vessels between the neck and shoulder.

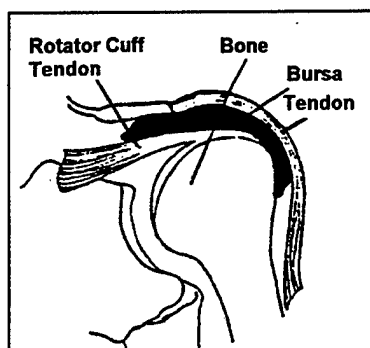


Figure 2.2
Shoulder and Neck Anatomy

2.2.1.1.2 Ergonomics Risk Factors. Several risk factors common in administrative work have been shown to increase the potential for shoulder/neck/arm disorders.

- Stressful positions or movements;
- Static (fixed) work;
- Heavy or forceful work;
- Insufficient recovery or rest pauses; and
- High frequency (repetitive) or high speed movements.

Below is a more complete description of these risk factors:

- Stressful positions or movements - during an extreme reach, tendons and a structure called the bursa sac are stretched. The more extreme the reach, the more stress on the shoulder joint. The most stressful shoulder positions are reaching to the side and behind the body and working over shoulder level.
- Static (fixed position) work - static work means 'fixed position' work. In cases where the height of the work is too high and the worker must raise his/her arms to hold a position or work on a item such as a keyboard, the muscles quickly fatigue.
- Heavy or Forceful work - forceful work on the shoulder includes push/pull forces. Examples include having to push or pull files in and out of shelves.
- Insufficient Recovery and Rest Pauses - fixed-position work often results in static muscular fatigue. Fatigue and/or discomfort in the shoulder and neck regions often develops. If no movement opportunities are built into the actual work, rest pauses can be provided which allow the muscles to recover. Specific exercises and stretches can also be performed during rest pauses to prevent the onset of static muscular fatigue.
- High frequency and/or high speed movements - the repeated use of stressful/awkward positions and/or excessive force is the primary concern. In addition, sudden 'jerky' movements cause shock to the joints.

2.2.1.2 Hands/Wrist/Arm

2.2.1.2.1 Disorders. (See Figure 2.3) The following conditions are the most common hand/wrist/arm disorders which may result from administrative work.

1. Tendonitis - an inflammation of the tendons.
2. Tenosynovitis - an inflammation of a tendon sheath most commonly at the wrist.
3. Carpal Tunnel Syndrome - the symptoms are a result of an irritation of the median nerve as it is compressed by surrounding tissue and bony structures in the wrist.
4. De Quervain's Disease - an irritation of the tendons of the thumb.
5. Trigger Finger - an inflammation of the tendon at the joint in any finger.
6. Ganglian Cysts - inflammation of the tendon sheath. The affected sheath swells up with the synovial fluid.
7. Epicondylitis - a tendon irritation of the forearm muscles at the elbow joint.

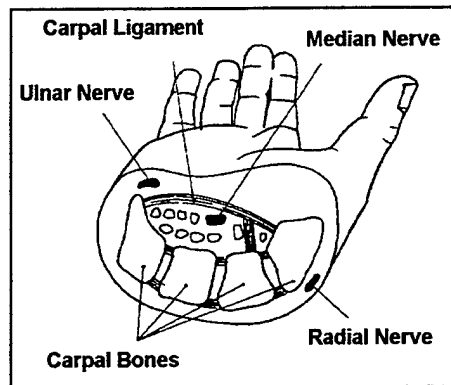


Figure 2.3
Anatomy of the Hand and Wrist

2.2.1.2.2 Risk Factors. The following lists the most common causes of hand/wrist/arm disorders, also referred to as "risk factors":

- Stressful positions and movements;
- Excessive forces or forceful exertions;
- High frequency or repetitions;

- Extreme duration and/or pace of the task;
- External trauma or mechanical stress;
- Prolonged exposure to vibration; and
- Temperature extremes.

Below is a more complete description of the risk factors. There are several points to remember. First, the presence of a risk factor does not necessarily mean that an injury or CTD will develop. Eliminating or even reducing the presence of any one of the risk factors will reduce musculoskeletal stress.

1. Stressful Positions and Movements - When the wrist is bent, the tendons and other soft tissues are under tension and compression. This stress can create microscopic damage that accumulates during the shift is repaired by the body during the off-shift. On other jobs, if the stress is excessive, the body's repair system can't keep up.
2. Excessive Forces or Forceful Exertions - Squeezing the mouse with a tight grip or a file, tapping the keys, or lifting a heavy object are examples of forceful exertion.
3. High Frequency or Repetition - Repeating the same task over and over ends to stress the same parts of the body over and over. The concern is not necessarily "repetitive jobs." Rather, the concern is repeated use of awkward postures and/or forces. If the first two risk factors can be eliminated, the 'frequency' of the task will have less impact on the worker.
4. Extreme Duration and/or Pace of the Task - Workers who perform the same stressful task (e.g. keying, filing) for the entire shift may be more likely to experience localized fatigue than workers who perform the task for shorter periods of time. The practices of using rest pauses and job rotation attempt to reduce task duration.
5. External Trauma or Mechanical Stress - The risk factor describes the effect of pressure points on the body. One example of external trauma is resting the wrist on the square edge of a desk.
6. Prolonged exposure to vibration - uncommon in an administrative setting.
7. Temperature extremes, especially cold - usually uncommon in an administrative setting, although employee complaints of cold hands may indicate that the presence of other task factors can increase discomfort.

2.2.1.3 Back/Torso

2.2.1.3.1 Disorders. (See Figure 2.4) As the basis for understanding disorders, the following components are used to understand the various functions of the back/torso anatomy and their function.

- Backbone (spine) - the major support structure of the body.
- Vertebrae - the bones which make up the spine
 - Cervical (C1-C7) supports and controls the movement of the head.
 - Thoracic (T1-T12) supports the upper body and has limited movement.
 - Lumbar (L1-L5) has the greatest flexibility and bridges the upper to lower torso.
 - Sacrum tail bone.
- Spinal cord - conducts impulses for movement and sensation (including pain) to and from the head and body.
- Foramen - spaces between the vertebrae through which spinal nerves exit.
- Discs - sponge-like tissues which separate vertebral bones and prevent the vertebrae from grinding against one another.
- Ligaments - attach one vertebra to the next.
- Muscles - provide support and enable the body to move from one posture to another.

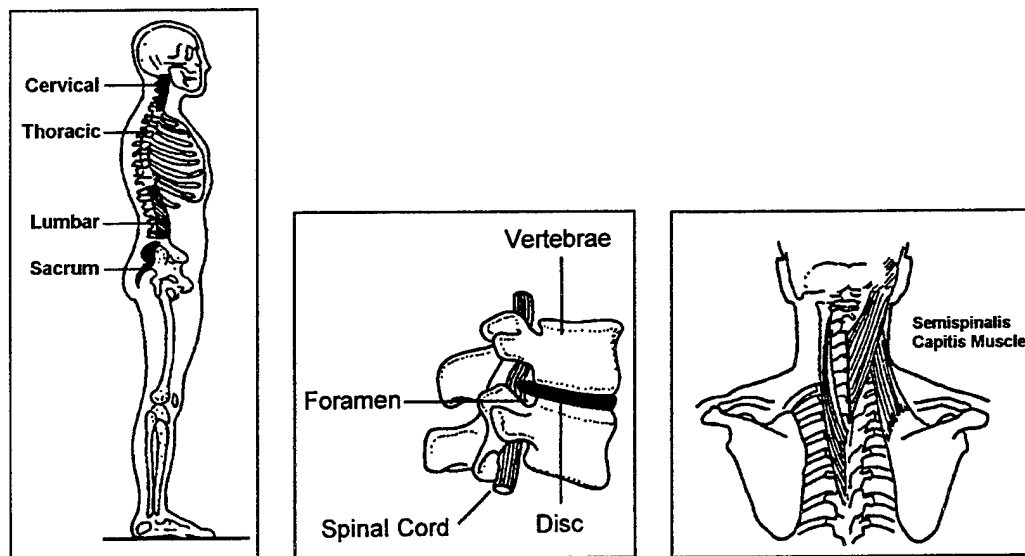


Figure 2.4
Back Anatomy

The following section discusses the common disorders associated with this area of the body:

- **Disc Degeneration** - with activity, intervertebral discs are stretched, torn, frayed, and worn. This can cause the disc wall to weaken, protrude, and, in some cases, press against the nerves. Weakening of the disc may also cause some narrowing of the space between the vertebra which reduces the size of the hole (foramina) through which the nerve passes as it extends into the legs (as shown in figure 2.5). If the narrowing of this space is significant, pressure may be directed against the nerve.

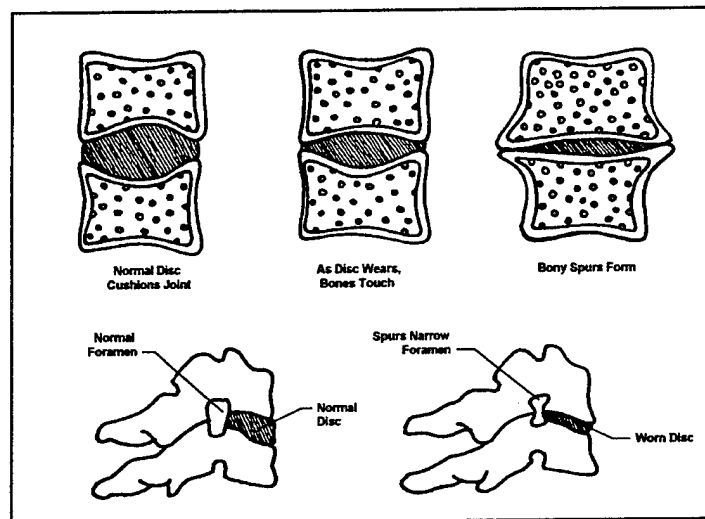


Figure 2.5
Disc Degeneration

- **Strains and sprains** - tearing or stretching of muscles, tendons or ligaments as shown in Figure 2.6.

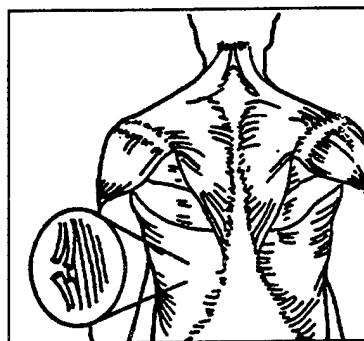


Figure 2.6
Sprains and Strain

2.2.1.3.2 Risk Factors. The following risk factors have been found to be associated with low back pain and back disorders:

- Awkward Postures - the degree or extent of forward bending appears to be the most significant concern. However, twisting and sideways bending also places uneven force on the spinal discs and muscles.
- High Force or Forceful Exertions - lifting heavy object or pushing overloaded carts can create an extreme force in the low back. For lifting, the closer to the body that an object can be kept during a lift, the less force in the low back. Both object weight and body position affect the amount of force and stress created in the low back.
- Static (fixed position) Work - when someone sits or stands in a fixed position for a long time, demands are placed upon certain muscles to maintain contraction. This may cause fatigue and discomfort in the low back. On the other hand, if the job is modified to give the worker an opportunity to move in a controlled fashion, the weight of the body is shifted between numerous muscle groups. By sharing the load among different muscles over time, one muscle group is allowed time to rest while another is working. This helps reduce the tendency for fatigue.
- High Frequency Lifting - repeated bending, twisting, or forceful work, especially lifting, increases stress and potential for long-term damage to the low back. One method used to reduce frequency is job and task rotation.
- Speed of Movement - the use of smooth body movements during lifting and other materials handling tasks helps reduce the risk of developing low back injury. Jerky or sudden, unexpected movements are associated with high force levels that may create injuries and should be avoided.
- Duration of Lifting- a worker who performs a material handling task continuously over an entire shift may be more likely to experience low back discomfort than a worker who does the job for only two hours. Job rotation can be used to reduce stress to the low back by reducing the duration of exposure to the stressful work.

2.2.1.4 Legs/Feet

2.2.1.4.1 Disorders. The following conditions are leg and feet disorders associated with standing, kneeling or bending tasks in administrative areas.

- Bursitis of the knee - an inflammation of the bursa sac in the knee joints.

- Varicose veins - prolonged pooling of the blood in the vein, especially in the lower leg.

2.2.1.4.2 Risk Factors. The following risk factors have been found to be associated with lower limb disorders.

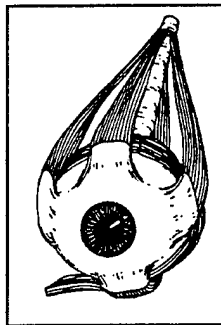
- Stressful Positions and Movements - kneeling or bending postures increase pressure inside the knee joint. Forced positions of the knees, such as those used when supporting the feet on the castors of the chair.
- Static Work (fixed positions) - prolonged standing or sitting while the back of the knee/thighs are compressed interferes with circulation. When standing in a fixed position, blood collects in the legs causing increased pressure on the blood vessels and joints.
- Excessive Forces - using the knees to apply pressure to a surface is one example of excessive force. The knee joint is also impacted internally when the worker assumes a kneeling posture.
- External Trauma - kneeling on a hard or uneven surface may cause immediate discomfort and long-term damage to the soft tissues of the knees.

2.2.2 Visual Issues. Eyestrain is the single largest category of health complaints among VDT users. Studies of visual discomfort among VDT operators regularly report that more than half of the operators experience eyestrain or related visual discomfort, and some studies report that as many as 94 percent of the operators suffer from visual complaints (Ong, 1984).

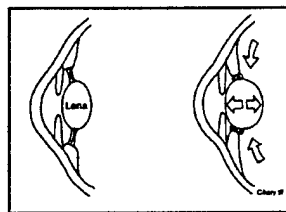
There is no question that VDT work is visually demanding, and that some existing visual problems may be exacerbated by VDT work. According to Bell Laboratories researcher Steven Starr, *The VDT does not seem to be a major new source of discomfort in the workplace. It does not stress the visual system more than analogous near-vision work done without VDTs and its use need not reduce job satisfaction.* (Starr, 1984). Nonetheless, VDT operators do experience eyestrain with great frequency. According to the Panel on Impact of Video Viewing, in most surveys, over 50 percent of VDT operators report some visual discomfort, and these complaints are common among clerical workers in general. Other researchers have found that VDT operators do not report eyestrain any more frequently than other clerical workers performing similar close visual work (Howarth and Istance, 1985). Still others have reported significantly more complaints from VDT users compared to other clerical workers, particularly among those using VDTs for more than four hours per day. Intensive data entry seems to generate more complaints than other VDT tasks (Levy and Ramberg, 1987).

2.2.2.1 Visual Complaints. (See Figure 2.7) It is important to know the anatomy of the eyes as a foundation for understanding the sources of complaints.

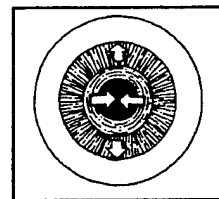
- Oculomotor muscles - control movement side-to-side and up-and-down and are used whenever they are searching or reading documents or screens.
- Ciliary muscles - control focusing by changing the shape of the lens to hold images in focus. They must adjust for any change in focal length when the eyes are looking at different distances.
- Iris muscles - control light intake (adjust size of pupils according to light intensity) and are affected by the light from the screen, document or surrounding area.



Oculomotor muscles



Ciliary muscles



Iris muscles

Figure 2.7
Eye Anatomy

2.2.2.2 Risk Factors. Glare on the VDT screen makes it more difficult for the user to see the character clearly and easily. Even though many VDT users complain of visual discomfort, there is no evidence that VDT use causes permanent eye damage. The discomfort, however, is real and needs to be addressed. Most of the discomfort results from users having to strain their visual system to compensate for the inadequate viewing conditions, which results in squinting, stretching, etc.

There are two types of **glare**: direct and reflected.

- **Direct glare** is caused by light sources within the visual field. This can cause "disabling glare" because it reduces the contrast at the retina reducing visual performance.
- **Reflected glare** is caused by the light rays bouncing off the screen (like from a mirror).

- It can be specular. Specular means that the operator can see the reflected image of the light source itself or the image of an object or person.
- It can be diffused glare. Light bouncing off floor or ceiling lights may be reflected with no clear visible pattern. The background simply appears brighter.

Other visual complaints include:

- **Excessive Ambient Light** - Many offices are too highly lit for effective VDT use, causing the user to adapt by overusing his/her eye muscles. Light sources in most offices include: natural light from windows; ceiling lighting; task lighting; reflective surface; screen surfaces.
- **Poor Display Quality** - If the characters are too small, or the edges blurred, or there is too little contrast between the characters and the background, the eyes must work excessively to focus on the characters. The color of the display is often considered an issue, but there are no definitive studies at this time to determine the best color use. However, extensive use of red and blue simultaneously has been shown to have negative effects.
- **Visual Disorders** - The eye does not always function properly. Some of the visual disorders people experience which affects their being able to see properly when working with a VDT are: far-sightedness, near-sightedness, and presbyopia.
- **Inappropriate Workstation Layout** - The position of the screen, the source document and reference materials are critical when considering the demands on the eye. The "focus" or "accommodation function" can also strain eye muscles.
- **Amount of VDT Use** - If workers have intense visual tasks all day and are working with tight schedules, they are more likely to have visual problems. The amount of uninterrupted time spent on use of the VDT can affect eyestrain.

2.3 CONCLUSION

One of the main purposes of this Guide is to provide you with the specific ergonomics principles which you can apply to 11 of the most common administrative tasks in order to reduce or effectively eliminate employee exposure to the risk factors. The intended result is to reduce the potential for WMDs and visual problems while maximizing employee performance.

3.0 USER'S GUIDE

This Guide will enable you to complete all aspects of the Level Ergonomics Assessment I and Problem-Solving Methodology. After the first few uses of the Guide, you will be able to efficiently identify job and/or task-specific ergonomics risk factors in all types of administrative work areas. Most importantly, however, you will be able to control employee exposure to those risk factors by matching practical and effective solutions to the problems that you identify.

3.0.1 When to Use this Guide. There are two situations for which use of the Level I Methodology is intended:

- users responding to an AF Form 190 investigation
- pro-active problem-solving based on results of the JR/PD Survey

For responding to an AF Form 190 investigation, the Methodology can be used to identify a potential job or task-based source of a WMD. For pro-active problem-solving, the Methodology can be used to conduct a systematic evaluation of an EPRA-designated shop. In both situations, the purpose is to specify which specific tasks may be the source of ergonomics hazards, and to identify and prioritize Corrective Actions for those tasks.

3.0.2 Five Step Process. A five step process is provided to keep your work focused and efficient.

- Step 1: Preparation
- Step 2: Risk Factor Identification
- Step 3: Prioritization of Hazards
- Step 4: Hazard Control Selection
- Step 5: Recommendations

The remainder of this section will demonstrate how you can apply the process for both situations.

3.1 STEP 1 - PREPARATION

Item(s) Required:	AF Form 190; or JR/PD Survey Summary Report

The purpose of Step 1 is to help prepare you for the shop visit. It is recommended that you complete Steps 2, 3, and 4 while you are in the shop, and Step 5 after you have returned to the BEF office. After applying the Methodology several times, you can decide what works best for you.

3.1.1 Logistics. In order to prepare for the shop visit and Steps 2, 3, and 4, you will need:

- An appointment with the work center supervisor
- At least one copy of the Level I Ergonomics Assessment Checklist
- At least one copy of the Ergonomics Summary Report
- The relevant Case Study Problem-Solving Matrices (see Note on Case Study Pre-Selection, below)
- A pencil or pen
- A calculator
- The AF Form 190 or results of the JR/PD Survey, depending on the situation.

It will be helpful for you to have a desk or work surface near the workstation for which you are conducting the assessment. You should plan on spending up to one and one half hours in the shop. Some visits will take less time. Others may take more time depending upon the situation.

Note on Case Study Pre-Selection:

There are 11 Case Studies that apply to administrative work areas:

- Using a Computer/General Word Processing - Case Study 1
- Writing/Illustrating - Case Study 2
- Stapling - Case Study 3
- Monitoring Visual Displays (Vigilance) - Case Study 4
- Calling (Telephone Use) - Case Study 5
- Copying/Sorting - Case Study 6
- CAD System Use (Drafting) - Case Study 7
- Filing/General Administrative - Case Study 8
- Use of Calculator/Numeric Key Pad - Case Study 9
- Lifting/Pushing/Pulling - Case Study 10
- Microscope Work - Case Study 11

For the first few assessments that you do, it is recommended that you take all of the Case Studies to the shop. Later, if you already know the types of tasks that are performed in the shop, you may pre-select the most relevant Case Studies (e.g., if you know that nobody in the shop performs microscope work, you may wish to leave this Case Study behind) and leave the others in your office. The Case Studies are located in Appendix 4.

3.1.2 Review of Relevant Data and Job Selection. If you are using the Guide as part of an AF Form 190 investigation, proceed directly to Section 3.2 Step 2 - Risk Factor Identification.

If you are using the Guide to conduct pro-active problem-solving in an EPRA-designated shop, complete the following steps.

- Step 1a. Obtain the JR/PD Survey Summary Report for shop from PHF. This Summary Report was used by the installation EWG to determine the work center's EPRA status.
- Step 1b. Review Step 7 on page 2 of the Summary Report. Listed in this section are the types of work (e.g., typing/keying) which were reported by over 20 percent of the employees. Your objective is to target the Level I Ergonomics Assessment and Problem-Solving methodology on jobs or job classifications (e.g., Contract Specialist, Contract Supervisor, etc.) which *include* these types of work or tasks.
- Step 1c. Review the Comments provided for Steps 8, 9, and 10 on page 3 of the Summary Report. These Comments, which summarize the comments and suggestions that participants in the survey completed, may identify very specific sources of ergonomics problems and/or improvement opportunities.
- Step 1d. Identify the job classification(s) (e.g., AFSC or civilian job series) which include the types of work identified in Step 1b. When you go to the shop, your first task will be to determine how many employees from each job classification you will need to include in your investigation.

A copy of a completed Form 190 and a JR/PD Survey Summary Report are provided in Appendix 1.

3.2 STEP 2 - RISK FACTOR IDENTIFICATION

Item(s) Needed: Level I Ergonomics Assessment Checklist

The purpose of Step 2 is to identify work-related risk factors to which the employee is exposed. You will use the Level I Ergonomics Assessment Checklist to complete Step 2.

If you are responding to an AF Form 190 investigation, proceed to Step 2f.

If you are using the Guide to conduct pro-active problem-solving in an EPRA-designated shop, complete the following steps.

- Step 2a. After entering the shop and introduce yourself to the shop supervisor, explain the purpose and process for completing the Level I Ergonomics Assessment Checklist.
- Step 2b. Ask the supervisor to tell you how many employees are in each job classification in the shop.
- Step 2c. Determine how many employees you need to observe/how many Checklists you will need to complete.

There is no firm rule on how many employees is a representative sample of a job classification or homogeneous group. You may want to begin by including 20 percent of the population or 3 employees, whichever number is greater. Or, if there are 3 or fewer employees in a job category, include all of the employees.

The following factors typically determine the number of Checklists that are required:

- the number of different workstation used;
- the number of different types of monitors & input devices used;
- the number of different types of workstation set-ups (e.g., locations of equipment on furniture, workstation adjustments);
- the distribution of critical tasks in the job (i.e., the list of critical tasks identified)

To complete the appropriate number of Checklists for each job type of classification, follow the steps below:

- Complete a Checklist for the first workstation, noting the furniture, equipment, workstation set-up and tasks performed.
- Go to the next workstation:
 - If there are **no significant differences** in the furniture, equipment, workstation set-up, or distribution of critical tasks for the next workstation, then use the *same* Checklist (same pieces of paper) for that workstation. Simply scan the workstation to make sure that the risk factor exposure is not significantly different.
 - If there are **significant differences** in the furniture, equipment, workstation set-up, or distribution of critical tasks, then complete a new Checklist for that workstation.
- Repeat this process for all workstations that make up the representative sample for the job classification. This will result in a single Checklist completed for each homogeneous group in that shop. A homogeneous group is a group of employees and their workstations which have similar characteristics (similar furniture, equipment, workstation set-ups, and critical task distributions). Develop recommendations for each Checklist. These

recommendations will apply (in general) to all workstations in the homogeneous group defined by that Checklist. That is, if there are three different homogeneous groups in one shop, there should be three Checklists and three sets of recommendations.

The remainder of this section describes the content (e.g., rationale for questions and responses and how the information will be used) and procedure for completing the Checklist for each employee.

3.2.1 Format. The Level I Ergonomics Assessment Checklist is comprised of a cover page and four parts.

- Cover Page
- Part I: Work Content (Description of Tasks Performed)
- Part II: Job Factors Checklist
- Part III: Environmental Factors Checklist
- Part IV: Employee Suggestions

3.2.2 Cover Page. The purpose of the cover page is to identify the work center (shop), location of the work, etc., as well as to specify selected employee demographics. You will use information on the top and bottom of the page for record keeping only.

Step 2f. Collect the information for the cover page from the employee. Record.

3.2.3 Part I: Work Content (Description of Tasks Performed). Part I helps you get the employee to describe, in a standardized way, the individual tasks which comprise his or her job. Eleven different task types are listed in a "Work Content Matrix." These task types are consistent with the administrative task types listed in Part III of the JR/PD Survey. For both analysis tools, the 11 task types were selected as representative of the most common types of administrative tasks. Additional space is provided to record other tasks that the employee described.

The Work Content Matrix is designed to allow one of five responses under the "Work Frequency" heading. The frequencies (e.g., never/na, non-routine, <1 hr., etc.) allow you to categorize the tasks by the amount of time devoted to the task on an a daily basis. A gray shaded area is superimposed in the Matrix to make a distinction between routine tasks and tasks which represent a less significant part of the job. The gray shaded area includes work frequencies of over 1 hour. All lifting tasks are considered critical tasks and should be included the assessment.

Information provided in the completed Matrix is very important. First, it enables you to break a potentially complex job down into smaller component or "tasks" that can be easily analyzed. Second, it enables you to maximize the value of the subsequent

assessment by focusing problem-solving efforts on the routine tasks - referred to for the remainder of the assessment as "critical tasks."

Performance measures are also recorded to help you justify the need for ergonomics improvement. For example, if the employee's performance is judged according to the number of typographical errors that are missed on a document and glare on the computer monitor makes those errors difficult to see, you may be able to obtain support for installing an anti-glare screen on the monitor since it may decrease the likelihood of errors, as well as reduce the potential for eyestrain.

Obtain the following information directly from the employee:

- Step 2g. Turn to Page 1, *Part I - Work Content* (Description of Tasks Performed.)
- Step 2h. Ask each employee to explain the *purpose of the job*. The objective is to develop a complete understanding of why the job exists and the type of work done by the employee. If a task is not listed on the checklist, use lines 12 to 15 to write in the task names (e.g., meeting with others) and mark the appropriate time estimate.
- Step 2i. *Fill out the Work Content Matrix*. Ask the employee to indicate how much time is devoted, on an approximately daily basis to each of the tasks listed in the first column of the Work Content Matrix. Be sure to let the employee know that if a task on the list is not part of the job, they should tell you so. Mark the appropriate circle in the gray shaded *Work Frequency* columns.
- Step 2j. *Ask about performance measures*. Ask the employee to describe the performance measures against which success in that job is rated. Some employees may not be able to provide this type of information if their performance has not been formally measured in the past. When this is the case, simply ask the employee, "How would you know whether a person doing your job was doing a good job? - What would you look for?" Record the responses in the *Work Performance* box on the bottom of page 1.

3.2.4 Part II: Job Factors Checklist. The format enables you to perform an ergonomics analysis for each of the critical tasks. The tasks are analyzed individually to identify the specific source of exposure to ergonomics risk factors. It is not usually the "job" (e.g., processing expense reports) that causes fatigue or discomfort. Rather, it is the individual "tasks" (e.g., uninterrupted use of a calculator for 4 hours, or talking on the phone while keying, etc.) that are the source. You may not be able to change the fact that the employee must process expense reports. However, it may be possible to address the part of the job that requires uninterrupted use of a calculator. Figure 3.1 shows one page of the Job Factors Checklist.

Figure 3.1
Job Factors Checklist

Level I Ergonomics Assessment for Administrative Work Areas

Page 2

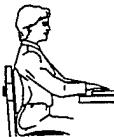
Part II - Checklist, Shoulder / Neck

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if BOTH
 - Task is performed greater than 4 hours per day AND
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur OR is not applicable.

Critical Tasks

	Job Factor	Task		Task		Task		Task		Comments
	1. Upper arms held away from body continuously while unsupported greater than 15° away from the body (e.g., using keyboard, mouse).	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	2. Repeated reaching arms greater than 15° away from the body, (e.g., obtaining reference manuals, filing, accessing telephone).	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	3. Shrugging working with both shoulders raised while arms unsupported (e.g., keyboard too high).	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	4. Repeated arm forces exceeding 10 lb. (4.5 kg.) (roughly equivalent to lifting a gallon of milk), (e.g., pulling files or stapling).	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	5. Holding/carrying materials exceeding 25 lb. (11.3 kg.) (e.g., 10" stack of files).	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	6. Cradling the telephone between the neck and shoulder	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	7. Head bent down, up, or neck is twisted (e.g., monitor or document too high, too low, off to side).	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	F=4 N=0	S=1	
	Task Scores = (column total)									

The *Job Factors* questions have been grouped into five “body zones”:

- shoulder/neck (Q1-Q7)
- hands/wrists/arms (Q8 - Q14)
- back/torso (Q15 - Q18)
- legs/feet (Q19 - Q21)
- head/eyes (Q22 - Q26).

The body zones are consistent with those used in the JR/PD Survey. The questions are representative of the types of ergonomics risk factors that are most likely to be found in Air Force administrative work areas.

The included questions were designed to ensure that each general risk factor type discussed in the scientific literature (e.g., posture, force, repetition, etc.) was reflected. The questions and illustrations were also designed to prevent the need for you to repeatedly refer to a glossary when completing the checklist (A glossary is provided in Appendix 2, however, to assist you the first few times you use the Checklist). No measurements are required. All of the questions may be answered based on observing the employee at work.

Detailed information on question design, interpretation, and research references, has been submitted to the USAF in a separate Research Report. Further information may be obtained from AL/OEMO.

For each question, you can assess the employee’s exposure to the Job (risk) Factor as: *Frequently, Sometimes, or Never/NA*. If the Job Factor occurs greater than 1/2 of the task time (e.g., the employee is exposed to glare “more” rather than “less” of the time) and the task is performed greater than 4 hours per day, you circle the *Frequently* response. If the Job Factor does not occur or the question is not applicable to the task e.g., if the employee reviews paper documents and question 25 - screen distance too far away or too close does not apply), you circle the *Never/NA* response. If the Job Factor does not meet the criteria for either the *Frequently* or *Never/NA* response, you circle the *Sometimes* response.

Only three response choices are provided to maximize the consistency of assessment results between users and minimize the need for interpretation and estimating actual time. It is significantly easier to decide if a Job Factor occurs “more” or “less” than 1/2 the time, than it is to make a consistent distinction between 1/3, 2/3, etc. The numerical ratings provided for each response were determined based on the relative contribution of the Job Factor type to work-related musculoskeletal disorders (WMDs) as well as the impact of exposure duration. For example, when the Job Factor *Upper arms held away from the body continuously while unsupported*, occurs greater than 1/2 of the task time and the task is performed more than 4 hours per day, the *Frequently* = 4 response is

selected. This indicates that the presence and exposure duration for this risk factor will have a greater impact on the shoulder than if the Job Factor occurred less than 1/2 of the task time and was rated, *Sometimes* = 1. Providing a numerical rating for each response allows the scoring process to be kept fast and easy.

A numerical Task Score is calculated for each task by adding the numbers in the column. The Task Score represents degree to which the task exposes the employee to ergonomics risk factors. The score is compared to evaluation criteria (0-3/Low, 4-7/Medium, and 8+/High) which allows you to establish priorities for problem-solving.

After obtaining a job description and a basic task frequency breakdown from the employee, you are ready to begin the *Part II - Ergonomics Checklist/Job Factors*.

Note: In some cases, the employee will not be performing all of the critical tasks at the time of your observation. When this is the case, ask the employee to demonstrate each of the critical tasks. Complete the Checklist for each task during the demonstration.

- Step 2k. Turn to Page 2, Part II - Checklist, Shoulder / Neck and review the definition for Frequently (F), Sometimes (S) and Never/NA (N).
- Step 2l. From Page 1 of the checklist, note the tasks from the marked circles in the gray area and write the task(s) on the blank lines under Critical Tasks. (e.g., stapling, copying).
- Step 2m. Next, answer each question for *each* task by circling (F), (S), (N).
- Step 2n. After you have answered *every* question for each task, compute the *Task Scores* (add each column and total at the bottom). The Comments box in the far right column is for additional notes regarding the tasks.
- Step 2o. Repeat the identical process four more times. Review each critical task again for Hands, Wrist, Arm, Back/Torso, Legs/Feet, and Head/Eyes, (pages 3-6), recording the results in the same way as for Shoulder/Neck.

3.2.5 Part III: Environmental Factors. Four questions (Q27 - Q30) are provided to assess potential exposure to general environmental factors (or stressors). Responses are provided on a 5-point scale. This section of the assessment is completed either by asking the employee to rate each one of the factors or by referring to environmental data already collected from previous industrial hygiene surveys (e.g., noise, indoor air quality-see Glossary in Appendix 2). Figure 3.2 shows the Environmental Factors.

Figure 3.2
Environmental Factors

Part III - Environmental

Environmental Factors

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
28. Noise and or other distractions (e.g., from printers or equipment, other employees)	0	0	0	1	4
29. Extreme Temperatures Chronically low or high temperature or extreme fluctuation	0	0	0	1	4
30. Air Quality Concerns	0	0	0	1	4
31. Restricted Space	0	0	0	1	4

Environmental Score =

Environmental Rating	Low	Med	High
Environmental Score	0-3	4-7	8+

This data indicates perceived employee exposure to environmental factors that may be impacting the way that the employee performs the job/tasks. For example, working in a restricted space may be one of the reasons why the employee must reach or lean forward. The environmental rating is not used to determine the overall job priority score or priority scores for individual tasks. It is, however, accounted for during problem-solving process.

Complete the following.

Step 2p. Turn to page 7, *Part III - Environmental* and answer the questions relating to Environmental Factors and circle the appropriate number.

Step 2q. Total the numbers and write the score in the Environmental Score box and circle the appropriate rating *High, Medium, or Low*.

3.2.6 Part IV: Employee Suggestions. Employee involvement is critical in the problem identification and problem solving processes. Employees who have previously completed the JRIPD survey may have already provided feedback on improvement opportunities. Your questions for the employee in Part IV have a slightly different focus. The JRIPD asked about general improvement opportunities for the shop. Part IV enables you to record any comments or suggestions that the employee may have on how to improve the job. Employee suggestions are to be thoughtfully considered and evaluated along with the controls provided in the Case Study Problem-Solving Matrices when you develop the final list of recommendations in Step 5.

Step 2r. Ask the employee for any suggestions for Corrective Actions that he/she may have. *The employee may provide you with improvement suggestions during the initial interview.* Record employee comments.

The Level I Ergonomics Assessment checklist is now finished. Next, go to the next workstation and repeat the process following the guidelines given on page 3-4.

A completed Level I Ergonomics Assessment Checklist and the Checklist Glossary is provided in Appendix 2.

3.3 STEP 3 - PRIORITIZATION OF HAZARDS

Item(s) Needed:	Completed Level I Ergonomics Assessment Checklist Checklist Scoring Summary

The purpose of this step is to “score” the Level I Checklist in order to determine the employee’s exposure to ergonomics risk factors from the individual tasks and from the job overall. You will use the Checklist Scoring Summary form to determine the exposure.

3.3.1 The Checklist Scoring Summary Design. There are three parts to the Checklist Scoring Summary:

- Job Description
- Scoring Summary
- Case Study Selection

The Case Study Selection part of the Checklist Scoring Summary form will be discussed in Step 4, HAZARD CONTROL SELECTION.

A *Job Description* section is provided to enable you to briefly summarize the job requirements and the purpose of the job/position.

The *Scoring Summary* design resulted from a combination of findings from the literature review as well as the consensus judgment from experienced ergonomists at TJI/ADL. In the literature, there is a lack of validated methods for determining a “threshold” between “ergonomics problem/risk of WMD” and “no ergonomic problem/no risk of WMD.” Therefore, the scoring concept and results generated by the assessment are designed to *prioritize* the need for Corrective Action based on the highest exposure to ergonomics hazards. In other words, a *High* rating means that exposure to risk factors which have been associated with WMDs is high. It does not mean that the risk for injury is high. When interpreting results, you should focus problem-solving efforts on any job, task, body region which is rated *High* or *Medium*.

Priority scores are generated for each body region, for each task, and for the overall job. Figure 3.3 shows the Scoring Summary.

Figure 3.3
Scoring Summary Section of the Checklist
Scoring Summary Form

2. Scoring Summary: Transfer scores from individual scoring sheets.

Body Region	Task Scores				Priority Score by Body Region	Priority Rating by Body Region
	Task Name:	Task Name:	Task Name:	Task Name:		Add across row and divide by # of tasks for average High: 8+ Med: 4-7 Low: 0-3
<u>Shoulder/Neck</u>					=	High Med Low
<u>Hand/Wrist/Arm</u>					=	High Med Low
<u>Back/Torso</u>					=	High Med Low
<u>Legs/Feet</u>					=	High Med Low
<u>Head/Eyes</u>					=	High Med Low

Select the highest body region score for each task then circle below for High, Med, Low	Highest Score	Highest Score	Highest Score	Highest Score
High: 8+ Med: 4-7 Low: 0-3	High Med Low	High Med Low	High Med Low	High Med Low

Environmental Rating	
High Med Low	

Overall Job Priority Score	
Highest Avg. Score by Body Region _____	High Med Low

3.3.1.1 Body Region Score. Body Region Scores for each task are determined by totaling the responses to the Job Factor Questions for each task. Body Region scores for the job as a whole are determined by averaging scores across tasks. The averaging process was selected to reflect the beneficial impact of task variety. Consider the following example jobs.

- Job A is comprised of just one task: computer work. This task exposes the shoulder/neck to a *High* level of ergonomics risk factors - Body Part Score = 8. Since there is only one task, the Body Region Priority Score=8, which is a *High* rating.
- Job B is comprised of two tasks: computer work and filing. This computer work task, which is performed for five hours per day, also exposes the shoulder/neck to a *High* level of ergonomics risk factors - Body Part Score = 8. The filing task, which is performed for three hours per day, exposes the shoulder neck to a *Low* level of ergonomics risk factors - Body Part Score = 2. The average Body Region Priority Score=5, which is a *Medium* rating.

A comparison of the Body Region Priority Score for each task suggests that Job B is easier on the shoulder than Job A. The *Medium* rating on Job B suggests that, since the employee spends part of the day performing a task (filing), which provides some relief to the shoulder, the overall potential for a shoulder problem is reduced. This is consistent with the ergonomics research literature which indicates that a job designed with task variety should reduce the overall potential for WMD development. Also, since the rating system still indicates that, when computer work is performed, the shoulder is at *High* risk, you are directed to identify controls which reduce exposure to ergonomics risk factors that impact the shoulder during computer work.

While averaging may not always reflect the precise daily physical experience of the employee, it provides you with a standardized method for determining the impact of overall daily exposure and how to focus problem-solving efforts in order to achieve the desired impact on employee health and safety. This concept can be referred to as high-impact, precision-strike problem-solving.

3.3.1.2 Task Score. The individual Task Score is determined by selecting the highest numerical body region score for that task. The highest numerical body region score is converted into a High, Medium or Low rating. The reason: the feeling of fatigue or pain, which are often precursors to WMD development, is not “averaged” throughout the body by the employee. For example, if exposure to a high level of risk factors causes an employee’s shoulder to hurt, the employee does not think, “my shoulder hurts, but the rest of my body is OK, so I must be OK.” Rather, the employee reports a shoulder problem because that part of the body hurts. Therefore, if the shoulder is exposed to a high level of ergonomics risk factors, the Task Score reflects that most significant exposure.

3.3.1.3 Overall Job Priority Score. The Overall Job Priority Score, *High*, *Medium*, or *Low*, is determined by selecting the highest Body Region Priority Score. The basis for this scoring concept is identical to that which was described for the Scoring Summary. The Overall Priority Rating is used to determine which jobs need the most immediate attention.

3.3.1.4 Use of the Scores and Ratings. While the Overall Job Priority Rating/Score is used to determine which *jobs* to address first. Task Ratings/Scores are used to determine which *task(s) within the job* need to be the focus of problem-solving efforts. And finally, the Body Region Scores for each task are used to target the identification of controls for the body parts that are exposed to the highest level of ergonomics hazards. Again, the objective is precision-strike focus, with high impact results.

There are three major steps to completing the Prioritization of hazards.

- Step 3a. Complete the top entries on the form (date, name, etc.).
- Step 3b. Complete the *Job Description* section. It is not necessary to write a detailed job description or to transfer the information from the Work Content Matrix. Simply describe, the main purpose of the job and what the employee does. (In some cases, the employee may be able to provide a written job description that you may use as the basis of the summary.)
- Step 3c. Complete the Scoring Summary.
- The first step is to transfer the names of the *critical tasks* selected for the Level I Ergonomics Assessment Checklist (e.g., stapling, copying) to the *Task Scores* columns.
 - Next transfer the *task scores* (column total) from each individual checklist (e.g., *Shoulder/Neck, Hand/*
 - *Wrist/Arms*) to the appropriate task column. Once you have transferred *all* task scores for *each* critical task it is time to select the highest body region score (per task).
 - Next, select the *highest* Body Region Score from each task and write the number in the *Highest Score* box at the bottom of each Task Name column. Then circle the appropriate box below for *High, Medium, or Low* for that task.
 - Now add across the rows and calculate the *average* to obtain a *Priority Score by Body Region*. (To obtain the average, add across the row and divide by the number of tasks.) Be sure to calculate the average for all

Body Regions (e.g., *Shoulder/Neck, Back/Torso* etc.) and then circle the appropriate response, High, Medium or Low for that body region in the *Priority Rating by Body Region* column.

- From page 7 of the Level I Ergonomics Assessment Checklist transfer *High, Medium or Low* Environmental Rating to the *Environmental Rating* box.
- Finally, at the bottom/right of the page complete the *Overall* box. Into this box, transfer the highest average body region score from the *Priority Score by Body Region* column above and circle *High, Medium or Low*.

A completed Checklist Scoring Summary is provided in Appendix 3.

3.4 STEP 4 - HAZARD CONTROL (Selection of Corrective Actions)

Item(s) Needed:	Completed Checklist Scoring Summary Case Study Problem-Solving Matrices (Appendix 4) Corrective Action List (Appendix 4)

Part 4 represents the start of the pattern-matching process.

3.4.1 Case Study Selection. Figure 3.4 shows the Case Study selection list from the bottom of the Checklist Scoring Summary.

**Figure 3.4
Case Study Selection List**

CASE STUDIES		
1. Use of Computer ☐ • Keying/Typing • Mousing	5. Calling (Telephone Use) ☐	9. Use of Calculator/Numeric Keypad ☐
2. Writing/Illustrating ☐	6. Copying/Sorting ☐	10. Lifting/Pushing/Pulling ☐
3. Stapling ☐	7. Drafting (CAD Systems) ☐	11. Microscope Work ☐
4. Monitoring Visual Display (Vigilance) ☐	8. Filing/Administrative ☐	

The idea is to select the Case Studies/titles that “match” the critical tasks that were identified during the scoring process in Step 3. This is the main connection between the Checklist results and the Case Study Problem-Solving Matrices. It is the foundation of pattern matching.

3.4.2 Case Study Design and Use. The Case Study Problem-Solving Matrices are the subject of Appendix 4. An overview of the Case Study Problem-Solving Matrix design, however, is provided here in the context of the pattern-matching process.

Eleven Case Study Problem-Solving Matrices were developed. The task types which were the basis for the Case Studies were selected by the Air Force and are consistent with "Types of Work" listed in Section III of the JR/PD Survey.

Each of the Case Studies presents the Job Factors commonly associated with the task type. For each Job Factor (e.g., *repeated reaching*), the causes of the Job Factor (e.g., *the mouse is located too far from the employee*) and a menu of controls that reduce or eliminate the Job Factor (e.g., *enlarge the keyboard tray so the mouse can be positioned next to the keyboard*) are provided.

The content of the Case Studies is based, in part, on a review of representative Air Force administrative tasks. However, the majority of Potential Causes and Corrective Actions - which were generalized such that they may be applied to *any* USAF administrative job - were extracted from the results of years of practical applications work completed by experienced ergonomists at TJI/ADL.

The information is organized in the following sections:

- *Task Title:* In most cases the task title is simply a restatement of the Case Study name. However, "Case Study 1: Use of a Computer/General Word Processing," is comprised of two primary tasks; keying/typing and mousing.
- *Task Description:* The task description provides details on the type of equipment that is typically used to perform the task (e.g., computer keyboard and/or electric typewriter, electric or manual stapler, etc.), the length of time over which the task is typically performed, and other materials that may be used (e.g., reference manuals). Also provided is a list of administrative jobs in which the task is performed (e.g., the "mousing" task is typically part of a desktop publishing job).
- *Job Performance Measures:* This section indicates which performance measures (e.g., error rates, number of documents processed per day, etc.) are typically impacted by implementing ergonomic improvements. This information, in addition to the job-specific performance measures obtained when completing the Level I Ergonomics Assessment Checklist, could be used by the Technician to justify the need for change.
- *Typical Employee Comments:* The information from this section is provided to help you judge whether or not employee comments obtained with the Checklist are consistent with problems or concerns that employees typically report for the task type. In other words, if an employee whose job involves continuous keying and typing comments about stiffness in the hand, you can check the "Typical Employee Comments" section of *the Use of a*

Computer/General Word Processing Case Study to see if the complaint is common for computer users. This information also helps you determine if you are looking at the most appropriate Case Study(ies) for the job.

- **Level II Analysis.** If you are unable to identify the causes or source of the ergonomics concerns, or if you feel that a more detailed analysis is required (e.g. complex job) each case study recommends the type of Level II analysis that may provide the information you need.
- **Job Factor, Potential Causes, Corrective Action.** The Case Study design enables you to make a direct match between the Job Factor present in the task, and that same Job Factor in the Problem-Solving Matrix. Figure 3.5 shows part of a Case Study.

Figure 3.5
Example Problem-Solving Matrix

Shoulder/Neck								
Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On		
			Minor Modification	Major Change		Quality	Productivity	
1. Arms held away from body	• Keyboard too high  Figure 1.1	85. Raise chair: • set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; • Note: in some cases, a footrest will be required in order to support the person's feet.	✓		low	low	low	
		30. Lower keyboard tray or work surface: • set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓		low to med	low	med	
	• Chair positioned too far away • Arms of chair interfere with moving chair closer.  Figure 1.2	33. Move chair closer to worksurface.	✓		low	low	low	
		90. Remove or lower armrests: • remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation. 78. Provide proper chair: • provide a chair in which the armrests can be adjusted or removed.	✓		low to med	low	med	

For example, if you observed that the employee's *Arms (were) held away from the body*, it is possible to match that Job Factor with the same Job Factor in the right-hand column of the Matrix. For each Job Factor, the ergonomists have identified the most common *Potential Causes* or aspects of the workplace or work procedure that, if they are not designed or adjusted properly, can cause the Job Factor to be present. If you were to decide that the arms are held away from the body because the *keyboard (is) too high*, you can then refer to the Corrective Action list to see what types of controls are available to address the problem of, *keyboard too high*. For this example, two choices are provided:

raise chair, and lower keyboard/work surface. You must decide which of the Corrective Actions would best control or eliminate the hazard.

The Case Studies also include information that helps you choose the control option which is in the best interest of the employee with consideration of the costs. For each control the *Level of Changes* column indicates if the control is typically a *minor modification* or *major change*. The controls that are listed as minor modifications involve little or no cost. In most cases this level of control can be implemented by making adjustments to the current work area. Approximately 75 percent of the controls provided in the Case Studies are at this level. The major change category includes controls such as *provide an alternative chair* or *provide an alternative work surface*. Controls listed in this category may be appropriate, but may need to be planned as a long-term change since they may be expensive.

Information on cost is provided only in general categories; *Low, Medium, and High*. This broad categorization was intentional and is based on an Air Force consensus. Every base may have a different idea about what represents *Low, Medium, or High* cost.

Still further, the Case Studies provide information on how implementation of the control is expected to impact quality and/or productivity. This information was compiled based on a consensus decision of experienced ergonomists at TJI/ADL who have seen similar results in their own application work. You may use this information as further justification for change.

3.4.3 Corrective Actions. The next step in the pattern matching process is to select the Corrective Actions in a Case Study that “match” the problems. As you identify an appropriate Corrective Action in a Case Study, you will check off that selection on the Corrective Action List. Part of the form provided in Appendix 4 has been excerpted as Figure 3.6.

Figure 3.6
Corrective Action List

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
82. Provide task light			
83. Provide telephone headset			
84. Raise Arm Rest(s)			
85. Raise chair			
86. Raise desk with 1 - 2 “ blocks			

In the Corrective Actions List, all of the controls from all of the Case Study Problem-Solving Matrices have been provided.

For instance, in the previous example, if you had identified that the employee's *arms (were) held away from the body* and that the cause was, *keyboard too high* and determined that *Raise chair*, was the appropriate solution, you would then make a "check" mark in the 85. *Raise Chair*, "Action Selected" box.

The Corrective Action numbers on the list are the same numbers in the Case Studies. This allows you to quickly locate and mark the control when using the Case Studies. Two response columns are provided: minor (modifications and adjustments), and major (major changes). The columns have been blocked such that the check mark is placed in the column that represents the level of control indicated in the Case Studies. This distinction is made in the Corrective Actions list to minimize the amount of time required for developing the final recommendations.

There is one additional column: "Implementation Reference." In this column you have been provided with a page reference in Appendix 5. Included on the referenced pages is additional detail which you may use to "implement" the corrective action. This information will be particularly important as you develop your final recommendation in Step 5.

There are 7 major steps in completing the Hazard Control selection.

- Step 4a. Preview the information in the Checklist Scoring Summary to select the Case Study Problem-Solving Matrices most appropriate for identifying controls.
- *Select the Case Study or Studies that match each of the Critical Tasks whose Task Score is a High or Medium. You may also choose to review case studies for "low" rated tasks at your discretion.*
 - Place a check mark in the appropriate box (or boxes) and then turn to the corresponding Case Study Problem-Solving Matrix (or Matrices) in the Case Study Problem-Solving Manual.

Now that you have identified the appropriate Case Study Matrix or Matrices you need to identify Corrective Actions. For this you will need to have the *Level I Ergonomics Assessment, the relevant Case Study Problem-Solving Matrices* (Appendix 4) and the *Corrective Action List* (Appendix 4) pages open for reference. Ideally, you should be near the workstation when identifying appropriate Corrective Actions.

- Step 4b. Turn to page 1 of the Corrective Action List, pages 1 through 3.
- Step 4c. Next open the Appendix 4 to the Case Study that you selected for a Task (e.g., *stapling*) with a *High* or *Medium* task.
- Step 4d. Open the Level I Ergonomics Assessment Checklist to Page 2, *Shoulder/Neck*. Look in the task column for *Stapling*. Note any of the Job Factor questions that are answered with *F* or *S*.
- Step 4e. Select an appropriate Corrective Action - place a check mark in the appropriate box on pages 1 through 3 of the Corrective Actions List.

For example if *Question 1, Upper arms held away from the body continuously while unsupported* scored *F* or *S*, then you need to suggest a *Corrective Action*. To Select a *Corrective Action* turn back to the *Shoulder/Neck* section of the *Stapling* Case Study and look for *Question 1-Arms held away from the body* under the *Job Factor Column*. Review the *Potential Causes* that apply and select the appropriate *Corrective Action*. On the *Corrective Action List*, record the appropriate *Corrective Action*. Examine the workstation to make sure the *Corrective Action* selected will be appropriate.

- Step 4f. Repeat Steps 4d and 4e for each Job Factor Question until you have completed the Pattern-Matching (Hazard Control Selection) process for the Task.
- Step 4g. Complete Steps 4a through 4f for each of the remaining *High* or *Medium* rated Tasks. You do not need to continue with problem-solving on tasks that were rated *Low*.

3.5 STEP 5 - RECOMMENDATIONS

Item(s) Needed:	Completed Checklist Scoring Summary Completed Corrective Actions List Level I Ergonomics Assessment Summary and Recommendations (Appendix 5)

The purpose of step five is to summarize all of the information from Steps 1-4 in a way that will enable you to communicate the key problems, causes, and recommendations for reducing and/or eliminating employee exposure to ergonomics to the shop supervisor. A Level I Ergonomics Assessment Summary and Recommendations form was developed to serve as the basis for a *concise report*.

The intent of the report is for you to summarize the findings of the Level I Ergonomics Assessment Checklist and record if the findings are consistent with previous findings from the AF Form 190 or the JR/PD Survey results, whichever one applies to the situation with which you are dealing. The report also allows you indicate to the shop supervisor which tasks need to be the focus of problem-solving.

The intent is for the supervisor to use the report for planning and implementing Corrective Actions. Since this is a summary, you should transfer only the most important information from the Checklist Scoring Summary and the Corrective Action List.

- Step 5a. Fill in the information on date, workplace identifier, base, etc. on the top of the Level I Ergonomics Assessment Summary and Recommendations form.
- Step 5b. In the *Critical Tasks in Priority Order* table, write in the Task Name(s) of any of the Critical Tasks that had a Task Score of *High* or *Medium*. The highest rated task goes in row 1, the next highest in row 2, etc. Note: if the Checklist Scoring Summary indicated that one or more of the Critical Tasks was rated Low, do not list the task(s) in this table.
- Step 5c. For each task, circle the *Task Rating (High or Medium)*. Then, circle the appropriate *Rating* for each *Body Region (High or Medium)*.
- Step 5d. Circle the *Overall Job Rating (High or Medium)*. Write in the Priority Body Region (e.g., *Shoulder/Neck, Back/Torso, etc.*).
- Step 5e. Indicate whether or not your results and findings are consistent with results from the JR/PD Survey (yes or no). Comment as appropriate. For example, one comment could be: "This job may contribute to the high risk factor and discomfort ratings for the shoulder/neck region reported for the shop." If your investigation was not prompted by the JR/PD Survey, check "N/A".
- Step 5f. Indicate if the results are consistent with Air Force Form 190 findings (yes or no). Comment as appropriate. An example comment could be "Each of the tasks performed by the employee exposes the employee to high to medium levels of ergonomics risk factors in the hands/wrists/arms region. This finding is consistent with employee-reported hand/wrist discomfort." If your investigation was not prompted by an Air Force Form 190, check "N/A".
- Step 5g. Provide recommendations for follow-up.

This is the final list of Corrective Actions that you wish to present and discuss with the shop supervisor. The list should be based on thoughtful consideration of the appropriateness of each of the controls that you marked in the Corrective Actions List. The idea *is not* to restate all of the controls. The idea *is* to suggest Corrective Actions that you believe should be implemented and that represent the best strategy for affecting workplace changes.

Provide recommendations for *Modifications and Adjustments*. Refer to the Corrective Actions List and look for the controls marked in the “minor” column. Evaluate each of the controls for appropriateness (e.g., will implementing the control reduce employee exposure to ergonomics hazards?) and practicality (e.g., is it realistic?). To evaluate the control, refer to the “Implementation Reference” page number provided for the corrective action. (Note: Not all corrective actions need further explanation than is provided in the case study. For these actions, no reference is provided). In the section “Implementing Minor Modifications” you can obtain additional detail or suggestions on how to implement the control. List the controls in priority order. Indicate whether or not you expect to see benefits to employee health/safety and/or productivity/quality.

Provide recommendations for *Major Changes and/or Purchases*. Refer to the Corrective Actions List and look for the controls marked in the *major* column. Again, evaluate each of the controls for appropriateness. Also include those controls that you think should be included in the shop’s long-term planning or budgeting process for the following period. By indicating whether or not you expect to see benefits to productivity/quality, in addition to employee health/safety, a shop supervisor or manager may be open to hearing more about a potentially major purchase.

When an Implementation Reference is provided, refer to the “Using Design Criteria to Implement Major Purchases” section. In cases where you recommend the purchase of equipment (e.g., document holder, chair, etc.), information in this section will help you select the appropriate choice based on ergonomics criteria.

The last step is to present the Summary and Recommendations to the shop supervisor and schedule a date for follow-up to measure the results of workplace improvements.

Figure 3.7
Level I Ergonomics Assessment
Summary and Recommendations

Date (YYMMDD)	Workplace Identifier:	
<i>(use this space for mechanical imprint)</i>	Base	Organization
	Workplace	
	Bldg. No./Location	Room/Area
	AFSC/Job Series	

CRITICAL TASKS IN PRIORITY ORDER

Task Name	Task Rating	Body Regions and Ratings (Circle one for each region)				
		Shoulder/Neck	Hands/Wrists/Arms	Back/Torso	Legs/Feet	Head/Eyes
1.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med
2.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med
3.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med
4.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med

OVERALL JOB RATING

RATING:	High	Medium	PRIORITY BODY REGION:
(Circle one)			(circle one) Shoulder/Neck Hand/Wrist/Arm Back/Torso Legs/Feet Head/Eyes

- Findings are consistent with results from Job Requirements and Physical Demands Survey (PHF): ☐ Yes ☐ No ☐ N/A
Comment: _____

- Findings are consistent with AF Form 190: ☐ Yes ☐ No ☐ N/A
Comment: _____

RECOMMENDATION FOR FOLLOW-UP

Modifications and adjustments	Major changes and/or purchases
Expected Benefits ☐ Health/Safety (Check all that apply) ☐ Productivity/Quality	Expected Benefits ☐ Health/Safety (Check all that apply) ☐ Productivity/Quality

INSERT TAB X HERE

APPENDIX 1

Preparation

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APPENDIX 1

This appendix corresponds with Step 1: Preparation. It provides completed examples for:

- a Job Requirements and Physical Demands Survey (JR/PD Survey);
- a JR/PD Survey Summary Report; and
- an AF Form 190.

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JOB REQUIREMENTS AND PHYSICAL DEMANDS SURVEY

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JRPD SURVEY

A completed survey is provided so that you can see the type of information on which the JRPD Survey Summary Report was compiled. One note of caution: the installation EWG does not make conclusions based on responses on individual surveys. This sample is provided only so that you understand the overall process.

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JOB REQUIREMENTS AND PHYSICAL DEMANDS SURVEY

Job Requirements and Physical Demands Survey	Date (YYMMDD) 960516	Workplace Identifier:	
(use this space for mechanical imprint)		Base Patrick AFB	Organization 45 SUS
		Workplace Base Library	
		Bldg. No/Location 722	Room/Area Library
		AFSC/Job Series GS1410	
Gender: Female ☒ Male ☐			
Work Group: Civilian ☒ Grade: _____ Military ☐ Rank: _____			
Age Category: 20 and under ☐ 21-30 ☐ 31-40 ☒ over 40 ☐			
Length of service at this base: less than one year ☐ more than one year ☒			
Length of time in current shop: less than one year ☐ more than one year ☒			
Have you completed this questionnaire before? Yes ☐ No ☒			

Part I - Job Factors

This section enables you to describe what is involved in your job. Indicate how long you do this work on approximately a daily basis.

A. DESCRIPTION OF WORK

SHOULDER / NECK

Never 0-2 hrs. 2-4 hrs. 4-8 hrs.

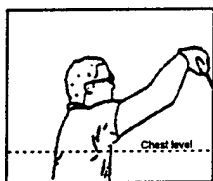


Figure A.

1. I work with my hands at or above chest level. (Figure A.) ☐ Never ☒ 0-2 hrs. ☐ 2-4 hrs. ☐ 4-8 hrs.

2. To get to or to do my work, I must lay on my back or side and work with my arms up. ☒ Never ☐ 0-2 hrs. ☐ 2-4 hrs. ☐ 4-8 hrs.

3. I must hold or carry materials (or large stacks of files) during the course of my work. ☐ Never ☐ 0-2 hrs. ☐ 2-4 hrs. ☒ 4-8 hrs.

4. I force or yank components or work objects in order to complete a task. ☒ Never ☐ 0-2 hrs. ☐ 2-4 hrs. ☐ 4-8 hrs.

5. I reach or hold my arms in front of or behind my body (e.g., using a keyboard, filing, handling parts, performing inspection tasks, pushing or pulling carts, etc.). (Figures B.) ☐ Never ☐ 0-2 hrs. ☒ 2-4 hrs. ☐ 4-8 hrs.



Figure B.

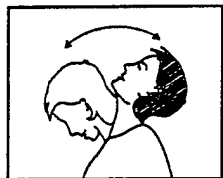


Figure C.

6. My neck is tipped forward or backward when I work. (Figure C.) ☐ Never ☐ 0-2 hrs. ☐ 2-4 hrs. ☒ 4-8 hrs.



Figure D.

7. I cradle a phone or other device between my neck and shoulder. (Figure D.) ☐ Never ☒ 0-2 hrs. ☐ 2-4 hrs. ☐ 4-8 hrs.

Part I - Job Factors (continued)

HAND/WRIST/ARM

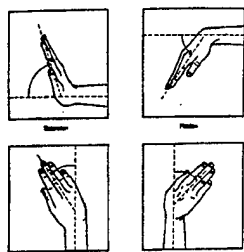


Figure E.



Figure F.

	Never	0-2 hrs.	2-4 hrs.	4-8 hrs.
8. My wrists are bent (up, down, to the thumb or little finger side) while I work. (Figure E.)	☐	☐	☒	☐
9. I apply pressure or hold an item/material/tool (e.g., screw driver, spray gun, mouse, etc.) in my hand for longer than 10 seconds at a time.	☒	☐	☐	☐
10. My work requires me to use my hands in a way that is similar to wringing out clothes. (Figure F.)	☒	☐	☐	☐
11. I perform a series of repetitive tasks or movements during the normal course of my work (e.g., using a keyboard, tightening fasteners, cutting meat, etc.).	☐	☐	☐	☒
12. The work surface (e.g., desk, bench, etc.) or tool(s) that I use presses into my palm(s), wrist(s), or against the sides of my fingers leaving red marks on or beneath the skin.	☐	☐	☐	☒
13. I use my hand/palm like a hammer to do certain aspects of my work.	☒	☐	☐	☐
14. My hands and fingers are cold when I work.	☐	☐	☐	☒
15. I work at a fast pace to keep up with a machine production quota or performance incentive.	☒	☐	☐	☐
16. The tool(s) that I use vibrates and/or jerks my hand(s) and arms(s).	☒	☐	☐	☐
17. My work requires that I repeatedly throw or toss items.	☒	☐	☐	☐
18. My work requires me to twist my forearms, such as turning a screwdriver.	☒	☐	☐	☐
19. I wear gloves that are bulky, or reduce my ability to grip.	☒	☐	☐	☐
20. I squeeze or pinch work objects with a force similar to that which is required to open a lid on a new jar.	☐	☒	☐	☐
21. I grip work objects or tools as if I am gripping tightly onto a pencil.	☐	☐	☒	☐

Part I - Job Factors (continued)

BACK/TORSO

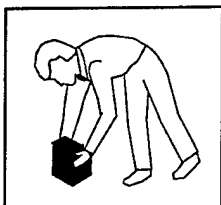


Figure G.

	Never	0-2 hrs.	2-4 hrs.	4-8 hrs.
22. When I lift, move components, or do other aspects of my work, my hands are lower than my knees. (<i>Figure G.</i>)	☐	☒	☐	☐
23. I lean forward continually when I work (e.g., when sitting, when standing, when pushing carts, etc.).	☐	☐	☐	☒
24. The personal protective equipment or clothing that I wear limits or restricts my movement.	☒	☐	☐	☐
25. I repeatedly bend my back (e.g., forward, backward, to the side, or twist) in the course of my work.	☐	☐	☒	☐
26. When I lift, my body is twisted and/or I lift quickly. (<i>Figure H.</i>)	☒	☐	☐	☐

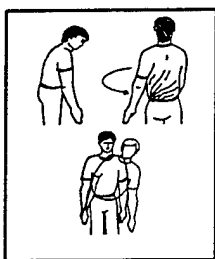


Figure H.

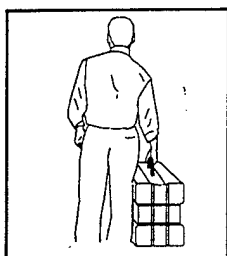


Figure I.

27. I can feel vibration through the surface that I stand on or through my seat.	☒	☐	☐	☐
28. I lift and/or carry items with one hand. (<i>Figure I.</i>)	☒	☐	☐	☐
29. I lift or handle bulky items.	☐	☒	☐	☐
30. I lift materials that weigh more than 25 pounds.	☐	☒	☐	☐

Part I - Job Factors (continued)

LEGS / FEET

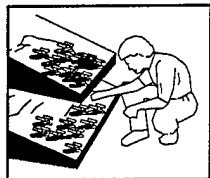


Figure J.

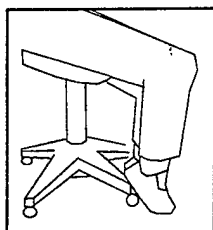


Figure K

	Never	0-2 hrs.	2-4 hrs.	4-8 hrs.
31. My work requires that I kneel or squat. (Figure J.)	☐	☒	☐	☐
32. I must constantly move or apply pressure with one or both feet (e.g., using foot pedals, driving, etc.).	☒	☐	☐	☐
33. When I'm sitting, I cannot rest both feet flat on the floor. (Figure K.)	☐	☐	☐	☒
34. I stand on hard surfaces.	☐	☒	☐	☐

HEAD / EYES

35. I can see glare on my computer screen or work surface.	☐	☐	☐	☒
36. It is difficult to hear a person on the phone or to concentrate because of other activity, voices, or noise in/near my work area. .	☒	☐	☐	☐
37. I must look at the monitor screen constantly so that I do not miss important information (radar scope).	☒	☐	☐	☐
38. It is difficult to see what I am working with (monitor, paper, parts, etc.).	☐	☐	☐	☒

Part I - Job Factors (continued)

B. ORGANIZATIONAL FACTORS

	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly Agree</i>
	1	2	3	4	5
39. I often feel unclear on what the scope and responsibilities of my job are.	☐	☒	☐	☐	☐
40. I often feel that I have too heavy of a workload, one that I could not possibly finish during an ordinary workday.	☐	☒	☐	☐	☐
41. I often feel that I will not be able to satisfy the conflicting demands of various people around me.	☐	☐	☒	☐	☐
42. I often find myself unable to get information needed to carry out my job.	☐	☐	☒	☐	☐
43. I often do not know what my supervisor thinks of me, how he/she evaluates my performance.	☐	☐	☐	☒	☐
44. I often think that the amount of work I have to do interferes with how well it's done.	☐	☐	☒	☐	☐

C. PHYSICAL EFFORT

45. How would you describe the physical effort required of your job?

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No exertion at all	Extremely light		Very light		Light		Somewhat hard		Hard		Very hard		Extremely hard	Maximal exertion
☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐

Part II - Your Body's Response to Work Demands

D. DISCOMFORT FACTORS

This section enables you to identify how your body responds to the demands of *your job*. In each section, answer the first question. If the answer is "no" go to the next column.

Question	Shoulder/Neck	Hands/Wrists/Arms	Back/Torso	Legs/Feet	Head/Eyes
In the past 12 months, have you experienced <u>any</u> discomfort, fatigue, numbness, or pain that <i>relates to your job</i>?	46. Yes ☐ No ☒ If "no", go to question 49	49. Yes ☒ No ☐ If "no", go to question 52	52. Yes ☒ No ☐ If "no", go to question 55	55. Yes ☒ No ☐ If "no", go to question 58	58. Yes ☐ No ☒ If "no", go to question 61
How often do you experience discomfort, fatigue, numbness, or pain in this region of the body?	47. Daily ☐ Weekly ☐ Monthly ☐	50. Daily ☐ Weekly ☒ Monthly ☐	53. Daily ☐ Weekly ☐ Monthly ☒	56. Daily ☐ Weekly ☐ Monthly ☐	59. Daily ☐ Weekly ☐ Monthly ☐
On average, how severe is the discomfort, fatigue, numbness, or pain in this region of the body?	48. Mild ☐ Moderate ☐ Severe ☐	51. Mild ☒ Moderate ☐ Severe ☐	54. Mild ☒ Moderate ☐ Severe ☐	57. Mild ☐ Moderate ☐ Severe ☐	60. Mild ☐ Moderate ☐ Severe ☐

Part II - Your Body's Response to Work Demands (continued)

E. GENERAL QUESTIONS

61. In the past 12 months, have you seen a health care provider for any pain or discomfort that you think **relates to your job**? Yes ☐ No ☒
62. Do you experience any work-related pain or discomfort that does not improve when you are away from work overnight or over the weekend? Yes ☐ No ☒
63. In the past 12 months, has any work-related pain or discomfort caused you difficulty in carrying out normal activities (e.g., job, hobby, leisure, etc.)? Yes ☒ No ☐
64. Has a health care provider ever told you that you have any of the following conditions which you think might be **related to your work**? Yes ☐ No ☒
- | | | | |
|--------------------------------|-----------------|--------------------------|--------------------|
| • Tendonitis/Tenosynovitis | • Ganglion Cyst | • Trigger Finger | • Overuse Syndrome |
| • Epicondylitis (Tennis Elbow) | • Bursitis | • Carpal Tunnel Syndrome | |
| • Thoracic Outlet Syndrome | • Back Strain | • Knee or Ankle Strain | |
65. Do you have or have you ever had one or more of the following conditions? Yes ☐ No ☒
- | | | | |
|--------------------|------------------------|--------------------|--------|
| • Wrist Fracture | • Rheumatoid Arthritis | • Diabetes | • Gout |
| • Thyroid Disorder | • Hypertension | • Kidney Disorders | |

Part III - Work Content

The section below will enable you to describe the content of the work that you do in your current shop.

Fill in the box that describes how frequently you do the task listed, based on the following definitions:

- **Routine:** Performed on three or more days per week.
- **Non-routine:** Performed two days a week or less.
- **Seasonal:** Performed only during certain times of the year
- **Never/NA:** You do not perform this type of work.

No.	Type of Work	Work Frequency (Check one)			
		<u>Routine</u>	<u>Non-Routine</u>	<u>Seasonal</u>	<u>Never/NA</u>
66.	abrading	☐	☐	☐	☒
67.	baking	☐	☐	☐	☒
68.	bolting/screwing	☐	☐	☐	☒
69.	calling (telephone use)	☒	☐	☐	☐
70.	chipping	☐	☐	☐	☒
71.	cleaning by hand	☐	☐	☐	☒
72.	cleaning with high pressure equipment	☐	☐	☐	☒
73.	coating/immersing	☐	☐	☐	☒
74.	cooking	☐	☐	☐	☒
75.	copying	☐	☒	☐	☐
76.	crimping	☐	☐	☐	☒
77.	cutting/shearing	☐	☐	☐	☒
78.	drafting/CAD system use	☐	☐	☐	☒
79.	drilling	☐	☐	☐	☒
80.	driving (vehicles)	☐	☐	☐	☒
81.	excavating	☐	☐	☐	☒
82.	filing/general administrative	☐	☒	☐	☐
83.	flame cutting/arc cutting	☐	☐	☐	☒
84.	folding/fitting	☐	☐	☐	☒
85.	gluing/laminating	☐	☐	☐	☒
86.	grinding/buffing/polishing	☐	☐	☐	☒
87.	hammering	☐	☐	☐	☒
88.	lifting	☐	☒	☐	☐
89.	loading (pallets, trucks, carts, aircraft)	☐	☐	☐	☒
90.	lubricating	☐	☐	☐	☒

Part III - Work Content (Continued)

No.	Type of Work	Work Frequency (Check one)			
		Routine	Non-Routine	Seasonal	Never/NA
91.	machining	☐	☐	☐	☒
92.	masoning	☐	☐	☐	☒
93.	melting	☐	☐	☐	☒
94.	molding	☐	☐	☐	☒
95.	monitoring (visual displays)	☒	☐	☐	☐
96.	mousing (for computer work)	☒	☐	☐	☐
97.	nailing	☐	☐	☐	☒
98.	opening/closing heavy doors	☐	☐	☐	☒
99.	packing/packaging	☐	☐	☐	☒
100.	painting/spray painting	☐	☐	☐	☒
101.	paving	☐	☐	☐	☒
102.	pumping (by hand)	☐	☐	☐	☒
103.	riveting/bucking	☐	☐	☐	☒
104.	sanding	☐	☐	☐	☒
105.	sawing	☐	☐	☐	☒
106.	scanning (using bar code readers)	☐	☐	☐	☒
107.	sewing	☐	☐	☐	☒
108.	soldering/brazing	☐	☐	☐	☒
109.	stapling	☐	☒	☐	☐
110.	stripping/depainting by hand	☐	☐	☐	☒
111.	stripping/depainting mechanically	☐	☐	☐	☒
112.	transporting loads on non-powered carts	☐	☒	☐	☐
113.	turning valves	☐	☐	☐	☒
114.	tying/twisting/wrapping	☐	☐	☐	☒
115.	typing/keying	☒	☐	☐	☐
116.	welding	☐	☐	☐	☒
117.	wheeling loads	☐	☐	☐	☒
118.	wiring	☐	☐	☐	☒
119.	wrenching/ratcheting	☐	☐	☐	☒
120.	writing/illustrating	☒	☐	☐	☐
	(Write in others)				
121.	_____	☐	☐	☐	☐
122.	_____	☐	☐	☐	☐

Part IV - Process Improvement Opportunities

Think about your job as a whole, including routine, non-routine or seasonal work.

Read the questions listed below and describe the activities that you or your co-workers think place the greatest demands on your body.

1. Which tasks are the most awkward or require you to work in the most uncomfortable positions?

My workstation is uncomfortable. I do a lot of work using the mouse.

2. Which tasks take the most effort?

As my chair has aged, it has become harder to adjust.

3. Are there any tools or pieces of equipment that are notoriously hard to work with? (If so, list them below)

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?

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JRPD Survey Summary Report

JRPD Survey Summary Report

You will need to refer to this report in cases when you are conducting pro-active problem-solving in EPRA-designated shops. Table A describes parts of the report that may be particularly helpful.

Table A
JRPD Survey Summary Report - Items to Include in Pre-Shop Visit Review

Where	Selected Items/Information	What it Tells You
Page 1	Steps 1, 2, and 3. Items A.1-A.5 and D.1-D.5 are combined using the Ranking Matrix to generate the Priority Rank for the shop. The highest score for any body region (e.g., shoulder/neck, back/torso, etc.) is used as the Priority Rank on which the EWG makes its initial judgment about EPRA status.	Look at the highest body part ratings for the shop as a whole. If the shoulder/neck, for example, gets the highest ratings, you may wish to pay special attention to risk factors/demands on the shoulder as you perform assessments in the shop. Also, if your Level I Checklist results generate a high relative score for the same region, you might conclude that the job/task which is the focus of your assessment, may be contributing to reported shoulder/neck problems throughout the shop.
Page 2	Steps 4 and 5. The Organizational Rating indicates the perceived level of "job stress" in the shop. The Physical Effect Factors score indicates people's overall perception of physical demands (e.g., easy, hard, etc.)	A "high" Organizational Rating could indicate that high levels of job stress (e.g., poor relationship with supervisor, high work load, etc.) throughout the shop may be increasing people's experience with pain and discomfort. While you are not necessarily responsible for dealing with job stress, employees may comment about it during the course of your assessment. A Physical Effect Factors score of 15 or higher indicates that employee's think the over job demands in the shop are "high" (15 = hard on the survey). You should be sensitive to this as you are performing the assessment.

Table A (Cont'd)
JRPD Survey Summary Report - Items to Include in Pre-Shop Visit Review

Where	Selected Items/Information	What it Tells You
Page 2	Step 6. Health care provider score. Activity Interruption percentage.	Health care provider score indicates number of employees who have received prior medical attention for a disorder. Activity Interruption percentage indicates the percentage of employees whose work or home activities have been affected by work-related pain or discomfort.
Page 2	Step 7. List of routine types of work.	This information is particularly important. This is the list of tasks that you will verify with the shop supervisor and from which you may select jobs to include in your proactive assessment.
Page 3	Step 8. Information on "potential concerns" and "improvement opportunities" within the shop.	Information in Step 8 may help you fine tune or prioritize the list of jobs you wish to include in your assessment. Pay close attention to the improvement opportunity remarks. Employees are providing you with some time-saving insight into what may help reduce ergonomics risk factors or pain/discomfort throughout the shop.

JOB REQUIREMENTS AND PHYSICAL DEMANDS SURVEY SUMMARY REPORT

Page 1

ERPA Status:	Priority Ranking:	Date:	
Date: 16 May 1996	Workplace Identifier:	Base:	Patrick AFB
Organization: 45 SUS	Workplace: Base Library	Bldg./Location:	722
Room/Area: Library	AFSC: N/A	Civilian Job Series:	GS1410
Shop Supervisor: K. Kessler	Duty Phone: X 6881	Office Symbol:	SVRL

Step 1	Step 2	Step 3
Write in the Risk Factor Rating for Part I, (questions 1-38, Scoring Sheet pg.1)	Write in the Discomfort Rating for Part II, (questions 46-60, Scoring Sheet pg.3)	Look at the "Ranking Matrix" below and enter the Priority Score in it's corresponding box.
A.1 High	D.1 Medium	Shoulder/Neck = 7
A.2 Low	D.2 Medium	Hands/Wrist/Arms = 3
A.3 Medium	D.3 Medium	Back/Torso = 5
A.4 Low	D.4 High	Legs/Feet = 6
A.5 Low	D.5 High	Head/Eye = 6

Ranking Matrix for Priority Score		Discomfort High	Discomfort Medium	Discomfort Low
Ranking Matrix	Risk Factor High	9	7	4
	Risk Factor Medium	8	5	2
	Risk Factor Low	6	3	1

Select the **HIGHEST** score for any body part from Step 3 and enter →

Survey
Priority
Rank:

7

JOB REQUIREMENTS AND PHYSICAL DEMANDS SURVEY SUMMARY REPORT

Page 2

Step 4

B. Enter Organizational Rating:
(Questions 39-44, Scoring Sheet pg. 2)

Med

Comments:

None

Step 5

C. Enter Physical Effect Factor Score: (Question 45, Scoring Sheet pg.2)

10.8

Comments:

None

Step 6

E. Enter the score for each of the General Questions: (Questions 61-65, Scoring Sheet pg. 4)

E.1 Health Care Provider Score

3 %

Comments: Three employees have sought medical treatment during the last year.

E.2 Recovery Time Score

17 %

Comments:

E.3 Activity Interruption Score

33 %

Comments: 1/3 of employees report that work-related pain/discomfort has affected job performance/hobbies.

E.4 Previous Diagnosis Score

50 %

Comments:

E.5 Contributing Factors Score

50 %

Comments: 1/2 of employees have been diagnosed with a condition that could cause them to report pain/discomfort.

Step 7

F. List below each of the routine types of work which had shop percentage scores over 20%. (Items 66-122, scoring sheet page 5)

Type of Work	%	Type of Work	%
Calling	30		
Lifting	50		
Monitoring	66		
Mousing	66		
Typing/Keying	66		

JOB REQUIREMENTS AND PHYSICAL DEMANDS SURVEY SUMMARY REPORT

Page 3

Step 8

Review Part IV (Questions 1-3) to identify tasks, tools, equipment, etc., that employees listed as potential concerns. Comment as appropriate.

Comments: *Constant use of mouse*

Review Part IV (Question 4) to identify potential improvement opportunities. Comment as appropriate.

Comments: *No improvement suggestions notes*

Step 9

Injury/Illness Data: Review the injury/illness history from this shop. Attach information and comment as appropriate.

Comments: *One employee has had surgery on both wrists (Carpal Tunnel Syndrome)*

Step 10

Conclusions / Recommendations Summary

Shop Status

EPRA

Recommendations for follow-up:

Refer to Bioenvironmental Engineering for Level I Assessment. Suggest beginning by investigating the type of tasks performed by the employee who has had surgery. Issues may be common to other employees or workstations. See also list of "routine" work from Step 7 (e.g., lifting, computer tasks)

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AF Form 190

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AF Form 190

Attached is a completed AF Form 190. Table B describes parts of the report that may be particularly helpful.

Table B
AF Form 190 - Items to Include in Pre-Shop Visit Review

Selected Items/Information	What it Tells You
Items 6 and 10. Work Location and Occupation (Job Title/AFSC)	This information may help you pin point the possible job or workstation source of reported potential ergonomics problems.
Item 25. Describe Job Tasks that Resulted in Exposure to Hazardous Materials/Agents (Specify the material/agent).	The more specific the information, the more helpful it will be to prepare for your assessment. If item 25 identifies, "clerical duties, administrative duties," you will still need to collect a detailed "task breakdown from the employee." At the very least, however, you know that the Case Study Problem-Solving Matrices for Administrative Work Areas will provide information that you use in problem-solving.
Item 12. Diagnosis and Relevant Medical Data.	This description will help you focus your assessment. In other words, while you will be completing the Level I Ergonomics Assessment Checklist in order to assess exposure for all of the body regions, knowing in advance that the person is suffering from an elbow disorder may make you more sensitive to risk factors for that body region.
Step 31. Bioenvironmental Survey.	One of the primary purposes of the Level I Ergonomics Assessment and Problem-Solving Guide for Administrative Work Areas is to provide you with the tools to supplement your own ergonomics expertise and enable you to complete this section.

FPO

Copy of completed AF Form 190

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OCCUPATIONAL ILLNESS / INJURY REPORT

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

95-517

I. PATIENT IDENTIFICATION				
1. NAME (Last, First, MI) [REDACTED]	2. SSAN [REDACTED]	3. GRADE ☐ MIL ☒ CIV	4. SEX ☐ M ☒ F	5. AGE 41
6. WORK LOCATION Elect Surv Ctr, Bldg 1840	7. DUTY PHONE 554-6541	8. ORGANIZATION AND SYMBOL ESC/SRSWRE	9. INSTALLATION Peterson AFB CO	
10. OCCUPATION (Job Title/AFSC) Computer Assistant 70335		11. SUPERVISOR (Name and Duty Phone) [REDACTED]		
II. INCIDENT / ILLNESS DATA				
12. DATE AND TIME OF EXPOSURE: ILLNESS: Oct 94		13. STATUS AT TIME OF EXPOSURE ☒ ON DUTY ☐ OFF DUTY ☐ LEAVE ☐ TDY ☐ OTHER		
14. DURATION OF EXPOSURE Oct 94 - Present (10 mo)		15. WITNESS (Name and Phone) Ms. [REDACTED]		
16. DESCRIPTION OF SYMPTOMS AT ONSET OF ILLNESS Numbness in fingertips on right hand and slight numbness of fingertips in left hand. Problems holding onto items. Occasional pain in both thumbs.				
III. MEDICAL DATA				
17. DIAGNOSIS AND RELEVANT MEDICAL DATA (Indicate affected body parts) 2 May 95 Mild right carpal tunnel syndrome 354.0		18. CLASSIFICATION ²		OSHA CODE
		OCCUPATIONAL SKIN DISEASE		21
		DUST DISEASE OF LUNGS		22
		RESPIRATORY CONDITION DUE TO TOXIC AGENT		23
		SYSTEMATIC EFFECT OF TOXIC MATERIAL (poisoning)		24
		DISORDER DUE TO PHYSICAL AGENT (Other than toxic material)		25
☒ DISORDER DUE TO REPEATED TRAUMA (Exclude hearing loss)		26		
☐ FATALITY		☐ RESULTED IN UNCONSCIOUSNESS		☐ OTHER OCCUPATIONAL DISEASE 29
19. DATE/TIME OF INITIAL TREATMENT/DIAGNOSIS 2 May 95		20. MEDICAL FACILITY 1625 Medical Center Point, Suite 212		
21. TREATMENT ADMINISTERED (Check One) ☐ FIRST AID ¹ ☒ DEFINITIVE CARE (Specify in Remarks)				
22. DISPOSITION OF PATIENTS				
YES	NO	NO. OF DAYS		
☒		RETURN TO NORMAL DUTY		ADMITTED TO HOSPITAL ²
☒		REFER TO PRIVATE PHYSICIAN		PLACED ON QUARTERS ²
	☒	EXCUSED FOR REST OF DUTY DAY		RETURN TO LIMITED DUTY ²
23. NAME OF MEDICAL OFFICER Dr. [REDACTED]				
24. REMARKS Numbness in hands and problems holding onto items began in October 1994. 2 May 95 - Dr. [REDACTED] prescribed use of a splint at night.				
IV. ENVIRONMENTAL DATA				
25. DESCRIBE JOB TASKS THAT RESULTED IN EXPOSURE TO HAZARDOUS MATERIALS / AGENTS (Specify the material / agent) Patient was performing word processing/data entry when she felt numbness in fingertips and pain in thumbs.				
V. CASE CLASSIFICATION				
26. OCCUPATIONAL INCIDENT ☒ YES ☐ NO		27. TYPE ☐ INJURY ☒ ILLNESS	28. WORKPLACE IDENTIFIER [REDACTED]	
29. REVIEWING OFFICER [REDACTED], Capt 43H3			30. DATE (YYMMDD) 950821	

1. One-time treatment of minor scratches, cuts, burns, and splinters which do not require professional care.

2. See AFR 127-12.

INSERT TAB X HERE

APPENDIX 2

Risk Factor Identification

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APPENDIX 2

This Appendix corresponds with Step 2: Risk Factor Identification, and includes:

- The Level I Ergonomics Assessment Checklist Glossary; and
- A sample of a completed Level I Ergonomics Assessment Checklist

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**LEVEL I ERGONOMICS
ASSESSMENT CHECKLIST GLOSSARY**

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GLOSSARY

This glossary provides information on each question in the checklist. Specifically, the glossary describes:

- how exposure to each job and environmental factor impacts the employee
- the ergonomics risk factor upon which the questions are based
- what to look for at the workstation (e.g., is the job factor present and to what extent)

The glossary follows the same order, question by question, as the Level I Ergonomics Assessment Checklist.

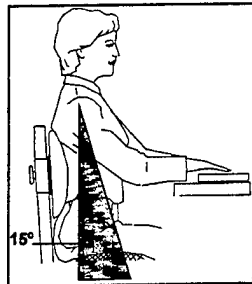
Note: As you gain experience using the Level I Ergonomics Assessment Checklist and with ergonomics in general, your reliance on this glossary should decrease significantly.

Checklist Questions for the Shoulder/Neck Body Area

Tables 1 through 7 explain the questions relating to assessment of Job Factors for shoulder and/or neck disorders.

Table 1
Checklist Question 1

Question: Upper arms held away from body greater than 15 degrees while unsupported away from the body (e.g., using keyboard, mouse).



Incorrect



Correct

Targeted Risk Factor Table

Risk Factor		Risk Factor	
x	Stressful Positions or Movements	x	Static (fixed position) work
	Heavy or forceful work		High Frequency (repetitive) or high speed movements

Background Discussion

A sustained posture of greater than 15 degrees from the neutral position has been shown to be associated with fatigue and tendonitis problems. When the arms are held away from the body and are not supported to maintain the arm in one position, static effort occurs. When static effort occurs, the flow of blood is somewhat constricted and over time, muscular fatigue will occur.

What to Look For

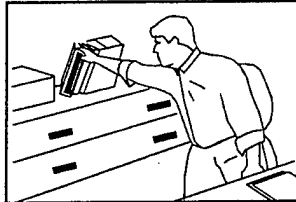
Look first to see if the arms are held away from the body. If the elbow is out to the side or in front of the body (e.g., you can see air space between the elbow and torso), you have identified the job factor. Refer to the illustration to help judge whether the arms(s), elbow(s), are further away than 15 degrees. This can occur when using a mouse that is located further away and at a different height than the keyboard.

Caution: If the arm(s)/elbow(s) are more than 15 degrees away from the body but the arms are supported (e.g., resting on a table top or other surface), this job factor is not present. (Note: sometimes the individual's body can act as a support).

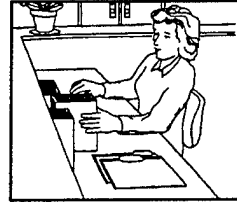
References: 4, 25, 26, 27

Table 2
Checklist Question 2

Question: Repeated reaching arms greater than 15 degrees away from the body. For example, when an individual is obtaining a reference manual, filing, or accessing the telephone.



Incorrect



Correct

Targeted Risk Factor Table

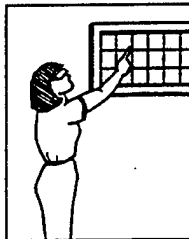
Risk Factor		Risk Factor	
x	Stressful Positions or Movements		Static (fixed position) work
	Heavy or forceful work	x	High Frequency (repetitive) or high speed movements

Background and Discussion

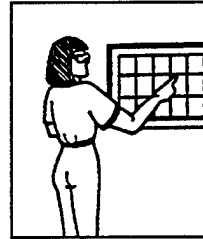
Posture, repetition, and duration have all been found to contribute to muscular fatigue. Posture considerations include positioning the arm away from the body greater than 15 degrees. Repetitive reaching in this area can cause fatigue and shoulder discomfort.

Explanation

Look first at the arms. If the arms are away from the body, as illustrated in the diagrams below, this is considered a forward reach beyond the neutral position. Repetition is characterized as reaching every 30 seconds or less or reaching during at least 50 percent of the work period. Putting mail into mail slots that are at shoulder height or above shoulder level is an example of this Job Factor.



Non-neutral



Neutral

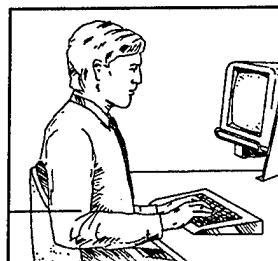
References: 6, 25, 28, 29

Table 3
Checklist Question 3

Question: Shrugging working with the shoulders raised while arms are unsupported (e.g., Keyboard too high).



Incorrect



Correct

Targeted Risk Factors

Risk Factor		Risk Factor	
x	Stressful Positions or Movements	x	Static (fixed position) work
	Heavy or forceful work		High Frequency (repetitive) or high speed movements

Background and Discussion

Activities requiring the shoulder to be held in an elevated position while the arms are unsupported may contribute to muscular fatigue. In order to lift (shrug) the shoulders the trapezius and deltoid muscles must continuously work/contract, leading to the onset of muscle fatigue.

Static effort can be considered as a factor when:

1. A high level of effort is sustained for 10 seconds or more.
2. Moderate effort occurs for one minute or more.
3. Slight effort (about one third of maximum force) last for four minutes or more.

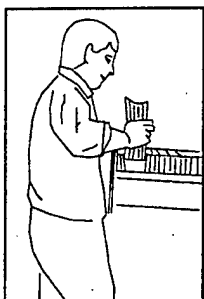
What to Look For

The worker holds one or both shoulders in an elevated position for prolonged periods of time. The individual appears to be shrugging/lifting the shoulders towards the ears. Examples include elevating the shoulder to compensate for a keyboard set too high or a chair which is set low in relation to the work surface.

References: 4, 6, 30

Table 4
Checklist Question 4

Question: Repeated arm forces exceeding 10 lb. or 4.5 kg. (roughly equivalent to lifting a gallon of milk). For example, pulling files or stapling.



Incorrect



Correct

Targeted Risk Factors

Risk Factor		Risk Factor	
x	Stressful Positions or Movements		Static (fixed position) work
x	Heavy or forceful work	x	High Frequency (repetitive) or high speed movements

Background and Discussion

Repetitive motions, posture, force, and duration can contribute to muscle fatigue. These can occur when pushing or pulling items of heavy weight or when an item is removed from a small or tight space.

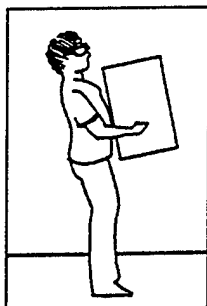
What to Look For

Estimate if arm forces exceed those required to lift a gallon of milk (about 10 lb. or 4.5 kg.). Fatigue and discomfort can occur when relatively few movement patterns are repeated, thereby stressing the same parts of the body over and over again. Examples include repeatedly pulling files from full drawers to pull the file loose, or repeatedly pressing down on a stapler or three-hole punch on thick documents.

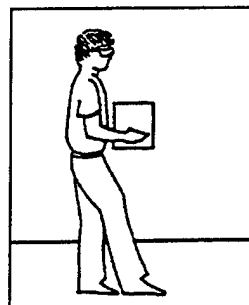
References: 6, 10, 31

Table 5
Checklist Question 5

Question: Holding/carrying materials exceeding 25 lb. (11.3 kg.) (e.g., 10-inch stack of files)



Incorrect



Correct

Targeted Risk Factors

Risk Factor		Risk Factor	
	Stressful Positions or Movements	x	Static (fixed position) work
x	Heavy or forceful work		High Frequency (repetitive) or high speed movements

Background and Discussion

Duration of the task, size of the load, position of the load, type of hand holds, and distance traveled all influence shoulder/arm muscle fatigue. Data suggests that for any component of the task the lowest percent of the population represents the maximum weight or force considered acceptable. This takes into account individuals of different size/stature/strength capabilities. *Items less than 25 lb. (11.3 kg.)* takes into account this variance in population and accommodates individuals with less muscle strength.

What to Look For

Determine (or ask) if the worker holds/carries objects exceeding 25 lb. (11.3 kg) in weight. Carrying a large stack of files, a full box of photocopy paper and/or a box of office supplies are examples.

References: 7, 32, 33

Table 6
Checklist Question 6

Question: Cradling the telephone between the neck and shoulder.



Incorrect



Correct

Targeted Risk Factors

Risk Factor		Risk Factor	
x	Stressful Positions or Movements	x	Static (fixed position) work
	Heavy or forceful work		High Frequency (repetitive) or high speed movements

Background and Discussion

Holding a telephone between the neck and shoulder requires a very stressful posture. Postures include elevation of the shoulder and tilting the head to one side. The nerves, vessels, and veins for the arm/wrist/hand exit at the base of the neck through a limited space known as the thoracic outlet. The nerves, vessels, and veins are vulnerable to compression which can occur when tilting the head to one side. Any constriction of this outlet may lead to pain or discomfort.

What to Look For

The telephone is positioned between the ear and shoulder. The shoulder is elevated and the head is tilted toward the shoulder.

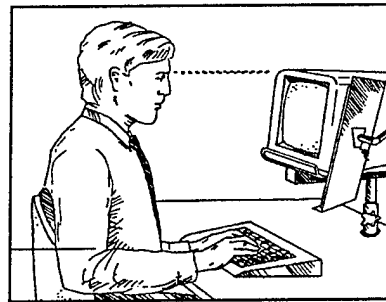
References: 13, 25, 34

Table 7
Checklist Question 7

Question: Head bent down, up or neck is twisted (e.g., monitor or document too high, too low, or off to one side).



Incorrect



Correct

Targeted Risk Factors

Risk Factor		Risk Factor	
x	Stressful Positions or Movements	x	Static (fixed position) work
	Heavy or forceful work	x	High Frequency (repetitive) or high speed movements

Background and Discussion

When the head is not upright and straight, muscle demands and stress can increase. As the head deviates from the upright position, muscle fatigue develops more quickly. Even a slight forward bend of the neck can produce significant muscle contraction which may contribute over time (e.g., 1 or 2 hours) to muscle fatigue or pain.

What to Look For

Look for the operator looking up or down or to the side in order to view the monitor or any reference documents. (The goal is to have the top line of text on the monitor and any reference documents at eye level.) For bifocal wearers, the monitor and reference documents should be visible through the bifocal lens when the head is held comfortably upright.

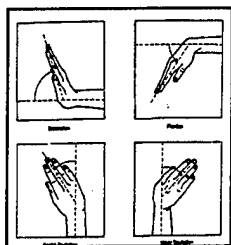
References: 12, 13, 25, 34, 35, 36

Assessment Questions for the Hand, Wrist and Arm

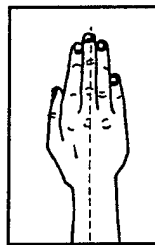
Tables 8 through 14 explain the questions relating to assessment of Job Factors for hands/wrists/arms.

Table 8
Checklist Question 8

Question: Bent wrists (e.g., Any instance when the wrist is not straight)



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Stressful Positions and Movements		External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
	High Frequency or Repetition		Temperature Extremes, Especially Cold
	Extreme Duration and/or Pace of the Task		

Background and Discussions

Postures that require the wrist to leave the neutral posture can increase stress (e.g., tension and compression in the wrist). As the wrist deviates from the neutral posture there is a decrease in effective strength. Wrist deviations such as bent forward or back, bent towards the little finger or thumb have been associated with a number of cumulative trauma disorders.

What to Look For

Look at the position of the keyboard or other equipment such as a mouse and see if the position causes the operator to flex, extend, or deviate the wrist to use the item.

Caution: The functional normal work hand position is tilted back approximately 10 degrees. This may appear to be deviation, but the position is not stressing the tendons.

References: 10, 27, 37

Table 9
Checklist Question 9

Question: Repeated wrist movements (e.g., keyboard, mouse, paper, equipment).

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Stressful Positions and Movements		External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
x	High Frequency or Repetition		Temperature Extremes, Especially Cold
	Extreme Duration and/or Pace of the Task		

Background and Discussions

Repeated movements out of the neutral position may directly damage tendons through repeated shortening and stretching, as well as increase the likelihood of fatigue and decrease the opportunity for tissues to recover. The task can be considered repetitive if the movement is performed every 30 seconds (or less) or 50 percent of the task time.

What to Look For

Look for the same movement patterns to be repeated over and over. These movements include flexion, extension, ulnar, and radial deviation of the wrist. This may be seen when repeatedly stapling, sorting paper, or operating a keyboard or mouse.

References: 10, 27, 37, 38

Table 10
Checklist Question 10

Question: Repeated finger movements (e.g., using keyboard, mouse, paper, equipment).

Targeted Risk Factors

Risk Factors		Risk Factors	
	Stressful Positions and Movements		External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
x	High Frequency or Repetition		Temperature Extremes, Especially Cold
	Extreme Duration and/or Pace of the Task		

Background and Discussions

Research has indicated that a high number of manipulations or movements per hour may contribute to the long-term development of hand wrist disorders. However, a quantified cause-effect relationship has not been established for the wrist or fingers.

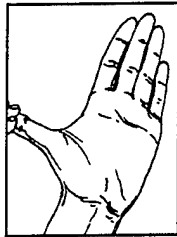
What to Look For

Look for the same movement patterns to be repeated, thereby stressing the same parts of the body over and over. These movements include flexion and extension of the fingers. This may be seen when repeatedly stapling, sorting paper, or operating a keyboard.

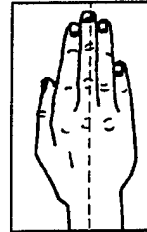
References: 38, 39

Table 11
Checklist Question 11

Question: Hyperextension of finger/thumb away from the rest of the hand (e.g., using ., small input devices).



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Stressful Positions and Movements		External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
	High Frequency or Repetition		Temperature Extremes, Especially Cold
	Extreme Duration and/or Pace of the Task		

Background and Discussions

Pinching or pressing with the tips of the finger, such as when hitting the keys of a keyboard or positioning the thumb away from the hand, can contribute to fatigue, pain or WMDs if the activity is repeated or sustained over an extended period of time. Deviated postures can place a load on muscles and tendons required to hold the position, and place stress on nerves and vessels, or create pressure on the structures within or around a joint.

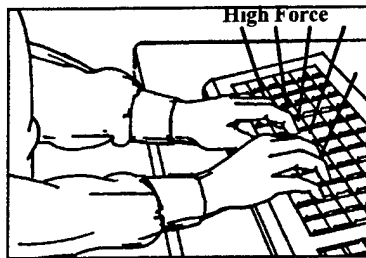
What to Look For

Look for the finger or thumb to be positioned out of the functional or neutral position. The thumb or finger will be positioned away from the hand, or extended back like when the hand is in the hitch hiking position. This may be caused by the design of a mouse or the position of a control such as the position of the space bar or the position on the keyboard.

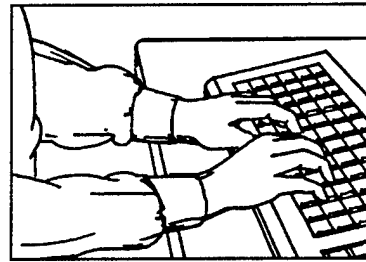
References: 12, 40

Table 12
Checklist Question 12

Question: Hand forces more than minimal force used to key; constant pinch force greater than 2 lb. (0.9 kg.) (e.g. squeeze staple remover, hitting keys, gripping mouse or pencil, pulling files). Constant full hand force greater than 5 lb. (2.3 kg.) (e.g., holding a gallon of water).



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Stressful Positions and Movements		External Trauma or Mechanical Stress
x	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
	High Frequency or Repetition		Temperature Extremes, Especially Cold
x	Extreme Duration and/or Pace of the Task		

Background and Discussions

High force grips (pinch or power) place a load on the flexor tendons that pass through the carpal tunnel. High tendon load may increase the risk of developing a WMD.

What to Look For

Look to see if the operator uses a pinch grip greater than 2 lb. (0.9 kg.) in order to complete the task. Examples include compressing a staple remover to extract a staple and striking the keys (hard) on the keyboard (one can hear the keys being tapped when away from the computer), or holding onto a pen or pencil. Full hand force greater than 5 lb. (2.3 kg.) can be seen when lifting items such as a box of photocopy paper with the finger tips.

References: 10, 31, 41

Table 13
Checklist Question 13

Question: Hard Edges - wrists or forearms rest on hard edges (e.g., desk, keyboard tray, arm rests.)



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Stressful Positions and Movements	x	External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
	High Frequency or Repetition		Temperature Extremes, Especially Cold
	Extreme Duration and/or Pace of the Task		

Background and Discussions

Localized mechanical stresses are caused by physical contact between soft body tissues and an object or tool in the work environment. Localized mechanical stress has been associated with trigger finger, median, and ulnar nerve damage. A precise cause-effect relationship, however, has not been determined.

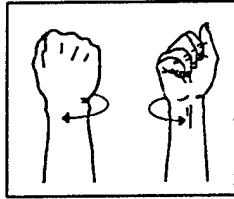
What to Look For

Look to see if the wrists or forearms are in contact with a hard edge while keying by resting on the edge of the keyboard tray, desk, or on the armrests.

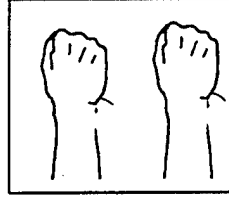
References: 13, 41, 42

Table 14
Checklist Question 14

Question: Repeated Forearm Rotation (e.g., flipping pages)



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Stressful Positions and Movements		External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
x	High Frequency or Repetition		Temperature Extremes, Especially Cold
	Extreme Duration and/or Pace of the Task		

Background and Discussions

Repeated turning of the forearms between pronation and supination have been noted as risk factors that may contribute to epicondylitis (elbow tendonitis) or muscle fatigue.

What to Look For

Look for the worker twisting or turning the wrists or forearms, back and forth while performing the task such as turning pages.

References: 13, 27, 37

Assessment Question for the Back Torso Body Regions

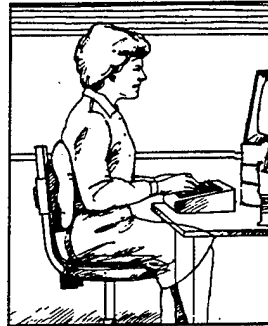
Tables 15 and 17 explain the questions relating to assessment of risk factors for back and torso disorders.

Table 15
Checklist Question 15

Question: Leaning forward or poor lower back posture.



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Stressful Positions and Movements		External Trauma or Mechanical Stress
	Excessive Forces or Forceful Exertions		Prolonged Exposure to vibration
	High Frequency or Repetition		Temperature Extremes, Especially Cold
x	Extreme Duration and/or Pace of the Task		

Background and Discussions

Positioning the back in a forward flex position is associated with increased spinal loading. If this position is maintained over an extended period of time, it can be associated with low back discomfort or pain.

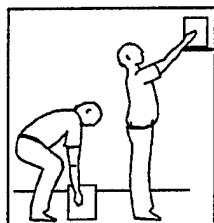
What to Look For

Look for the individual leaning forward and a space (two or more fingers wide) existing between the back and the backrest of the chair. Leaning forward becomes a risk factor when the individual maintains this posture for a period of time, it is not a risk factor when the individual is simply making a change in his/her sitting posture. Changing the position of the back is healthy for the muscles, spinal discs and other tissues of the back.

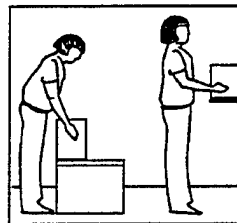
References: 52

Table 16
Checklist Question 16

Question: Repeated Bending while standing greater than 45 degrees forward, bending or any observable leaning to the side, twisting, or backward bending (e.g., lifting below knee height).



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Awkward Postures		High Force or Forceful Exertions
	Static (fixed positions) Work		High Frequency Movements or Lifting
	High Speed Movements		Duration of Lifting

Background and Discussions

Frequent lifting has been correlated with increased low back injury rates. Studies suggest that using a squat lift (lifting with bent knees and a straight back) puts less pressure on the disc than using a stoop lift (lifting with straight knees and a bent back). Repeatedly bending the spine, especially when twisting is involved, can weaken the disc and lead to injuries such as disc protrusions -- a bulging of the outer wall of the disc that can press against the nerve.

What to Look For

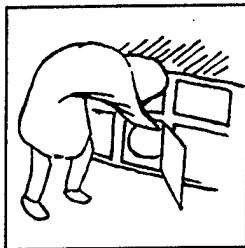
Look for the worker who is repeatedly lifting, pushing, or pulling while bent forward, bent sideways, or twisted. Lifting a series of boxes of photocopy paper from the floor or leaning forward to check items off a check-sheet are examples.

References: 13, 25, 26, 43

Table 17
Checklist Question 17

Question: Lifting Forces:

- handling greater than 50 lb. (22.7 kg.) while close to body;
- handling greater than 10 lb. (4.5 kg.) while bent and/or reaching (or while seated); or
- high speed movements.



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Awkward Postures	x	High Force or Forceful Exertions
	Static (fixed positions) Work		High Frequency Movements or Lifting
x	High Speed Movements		Duration of Lifting

Background and Discussions

Many aspects of the physical act of manually lifting a load have been identified as potentially hazardous to the musculoskeletal systems. They include:

- Weight (force required) and stability;
- Frequency/Duration/Pace (repetitiveness of handling);
- Coupling (texture, handle size and location, and shape);
- Workplace layout (movement distance, direction, obstacles, and postural constraints); and
- Environment (factors such as temperature, noise, humidity, illumination, vibration, and stability of the foot).

Table 17 - Question 17 (cont'd.)

What to Look For

The worker is required to lift more than 50 lb. (22.7 kg.) in an upright posture, or more than 10 lb. (4.5 kg.) when bending forward to the floor such as lifting a full box of photocopy paper from the floor. In many cases, it may be a good idea to ask the employee if the task includes either of these conditions.

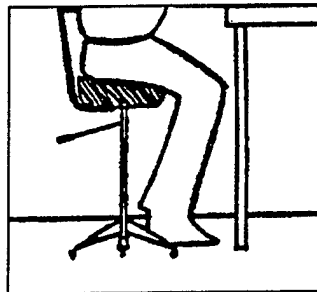
References: 13, 15

Assessment Question for Legs and Feet Body Region

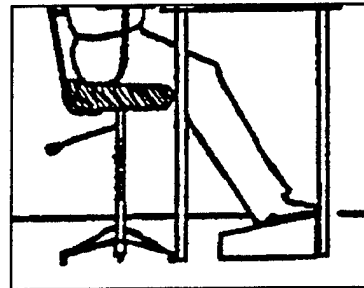
Tables 18 through 21 explain the questions relating to assessment of risk factors for the feet and legs.

Table 18
Checklist Question 18

Question: No foot support when sitting; feet cannot rest flat on the floor (e.g., feet dangling, feet tucked back, legs crossed, sitting on leg, etc.) or foot support not used.



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Stressful Positions and Movements		Static (fixed positions) Work
	Excessive Forces		External Trauma

Background and Discussions

When the feet are not supported or are positioned in constrained postures such as feet tucked back or the legs crossed, pressure can be placed on the nerves, vessels, and veins on the under surface of the thigh or behind the knee. Pressure on these structures can restrict circulation, impact sensation, and cause discomfort.

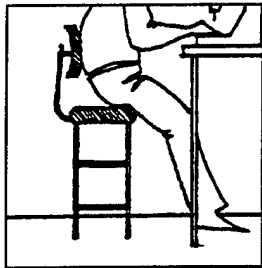
What to Look For

Look for the feet dangling, the person sitting on one leg, crossing the legs, or having the feet positioned on the base of the chair. This can occur when the chair is too high to comfortably rest the feet on the floor or a foot support is not provided or used.

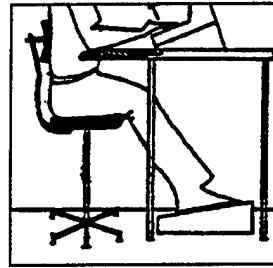
References: 13, 25

Table 19
Checklist Question 19

Question: Edge of seat or work surface presses into legs.



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Stressful Positions and Movements		Static (fixed positions) Work
	Excessive Forces	x	External Trauma

Background and Discussions

When the seat pan exceeds the length of the thigh, pressure from the edge of the chair can be placed on the nerves, vessels, and veins on the under surface of the thigh or behind the knee. Pressure on these structures can restrict circulation and impact sensation. This can also occur when a surface (e.g., inappropriately designed or positioned articulating keyboard tray) presses into the top or sides of the legs.

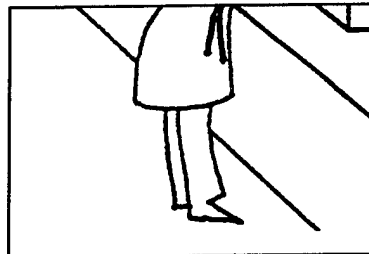
What to Look For

Look to see if the length of the seat pan exceeds the workers' upper-leg length or if the edge of the chair presses into the back of the knee area. Also, since circulation and sensation can also be affected when the vertical leg room at the work station is limited, look to see if the upper thigh presses against the under side or edge of the work surface. The proper seat pan depth/leg length combination is when the individual can get two to three fingers comfortably between the knee and the seat pan edge.

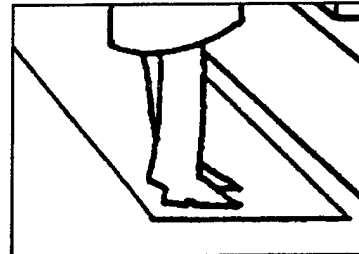
References: 13

Table 20
Checklist Question 20

Question: Hard floor surface: standing and/or walking on hard surfaces.



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Stressful Positions and Movements	x	Static (fixed positions) Work
	Excessive Forces		External Trauma

Background and Discussions

Standing in one position for prolonged periods can contribute to pooling of the blood in the veins especially in the lower leg. Such conditions can contribute to varicose veins, swelling of the tissues in the lower legs and feet, and blisters in the swollen areas. Prolonged standing can also increase muscle fatigue in the lower back.

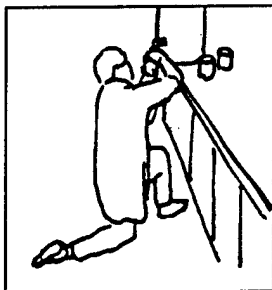
What to Look For

The operator stands for prolonged periods of time on a hard floor surface. The work area restricts varying standing postures, or prevents shifting weight from one limb to the other.

References: 13, 26

Table 21
Checklist Question 21

Question: Kneeling/squatting.



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Stressful Positions and Movements		Static (fixed positions) Work
	Excessive Forces	x	External Trauma

Background and Discussions

Kneeling or squatting have been included in the OSHA checklist. Kneeling or squatting for extended periods of time can create stress and strain on the ligaments of the knee. Kneeling can also create direct pressure on the bursa sac in the knee joints and causes inflammation or bursitis of the knee.

What to Look For

The worker bends more than 20 degrees at the hips and knees, or squats while performing a task. The worker kneels on a hard surface without knee pads or the use of a padded surface for an extended period of time.

References: 13, 44

Assessment Questions for the Head and Eye Body Region

Tables 22 through 26 explain the questions relating to assessment of risk factors for stress to the head and eyes.

Table 22
Checklist Question 22

Question: Staring at screen or document.			
Targeted Risk Factors			
	Risk Factors		Risk Factors
	Excessive Accommodation		Excessive Adaptation
x	Static Work Postures		
Background and Discussions			
Studies indicate that the eye tends to focus or stare on the screen for extended periods of time without blinking or at a rate less than one would experience when reading the written or printed document. This can create eye strain and fatigue as well as dryness.			
What to Look For			
The individual stares at the screen or document without blinking or periodically looking away from the document. The individual may complain of tired or dry eyes.			
References: 20			

Table 23
Checklist Question 23

Question: Glare (e.g., on computer screen, work surface from overhead lights/windows).			
Targeted Risk Factors			
Risk Factors		Risk Factors	
	Excessive Accommodation	x	Excessive Adaptation
	Static Work Postures		
Background and Discussions			
Glare can be seen in two forms: indirect and direct glare. Indirect glare typically results from reflections of the overhead lights or light off the visual task (monitor). Direct glare can occur when a light shines directly into the eyes from inside or outside light sources. Both types of glare can contribute to eye strain and fatigue.			
What to Look For			
Look for reflections from overhead lights and windows that are visible on the monitor screen. Make sure your eyes are at the same height as the employee's eyes when you check for this Job Factor. Also look for bright windows or unshielded task lights that are visible to the worker. If you are unsure of the source use a mirror. Place the mirror on the monitor facing the operator- the glare source should be easy to identify.			
References: 21			

Table 24
Checklist Question 24

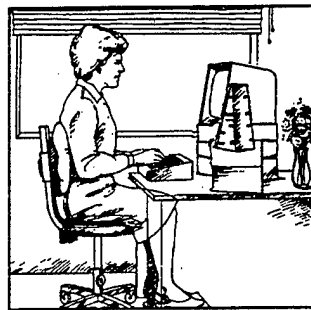
Question: Light levels too high or too low.			
Targeted Risk Factors			
Risk Factors		Risk Factors	
	Excessive Accommodation	x	Excessive Adaptation
	Static Work Postures		
Background and Discussions			
Light levels which are too bright or too dark can increase visual error rate and cause eye strain and fatigue. Overall light levels for computer work stations should be between 200 to 500 lux (20-50 foot-candles). Light levels below this level may cause the individual to squint or lean forward in the chair.			
What to Look For			
Ambient light levels should be between 200 lux to 500 lux (20 to 50 foot-candles) in work areas where mainly VDTs are used. For areas where general paper-based tasks are done in conjunction with VDT use, task lights need to be used so that the light on the documents is between 500 and 1000 lux (50 to 100 foot-candles).			
References: 22			

Table 25
Checklist Question 25

Question: Screen distance too far away (greater than 30 in. / 76.2 cm.) or too close (less than 18 in. / 45.7 cm.).



Incorrect



Correct

Targeted Risk Factors

Risk Factors		Risk Factors	
	Excessive Accommodation		Excessive Adaptation
x	Static Work Postures		

Background and Discussions

Documents or screens that are positioned greater than 30 in. (76.2 cm.) or less than 18 in. (45.7 cm.) are too far or too close for comfortable viewing over an extended period of time. If the viewing task is positioned too far, the individual may squint or lean forward in the chair. When the task is too close, the individual may squint or lean back in the chair. Both methods of compensation can create eye strain as well as fatigue and discomfort in the neck and back.

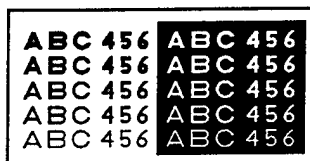
What to Look For

Look to see if the monitor or document is closer than 18 in. (45.7 cm.) or further than 30 in. (76.2 cm.) from the viewer's eyes. Hint: An individual's elbow to finger tip length is usually greater than 18 in. (45.7 cm.) in most cases.

References: 21

Table 26
Checklist Question 26

Question: Difficult to read computer screen; documents are difficult to read (e.g., text too small, poor display quality).



Targeted Risk Factors

Risk Factors		Risk Factors	
	Excessive Accommodation	x	Excessive Adaptation
	Static Work Postures		

Background and Discussions

Low brightness, use of colors between the background and foreground contrast on the screen and the document, size, spacing, and style of character can affect the legibility and readability of the monitor and/or document. These factors can contribute to eye strain and fatigue.

What to Look For

Look for insufficient contrast between characters and the background on the monitor and reference documents for good legibility. For example, gray text on a white background/green text on a blue background or red text on a purple background can decrease legibility and readability.

References: 45, 46

Introduction to Environmental Factors

Environmental risk factors of the office environment include:

- Excessive noise - Background noise in the office can be annoying, distracting, fatiguing or interfere with communication even though the noise levels are below the legislated limits.
- Excessive Temperatures - Most individuals operate comfortably in an office environment when the air temperature is in the high 60's to low 70's° F (low to mid 20's °C). Poor heat and ventilation control can contribute to fatigue and discomfort.
- Awkward Postures - Restricted space layout or arrangement of equipment can lead to awkward postures. These postures can contribute to fatigue or discomfort of the body part awkwardly positioned.
- Poor Quality of Air - poor air quality can affect health, comfort and performance of office worker.

Assessment Questions

Environmental factors are described in Tables 27 through 30.

Table 27
Checklist Question 27

Question: Noise and/or other distractions (e.g., from printers or equipment, or other employees).

Targeted Risk Factors

Risk Factors		Risk Factors	
x	Excessive Noise		Extreme Temperatures
	Static Work Postures		Poor Air Quality

Background and Discussions

Sounds in office environments are usually well below acceptable limits required by law and are not high enough to contribute to either permanent or temporary hearing loss. Background noise in the office can still be annoying, distracting, fatiguing or can interfere with communication.

In an office environment, there are basically five main sources of background noise:

1. external noise from traffic, construction;
 2. internal facility generation of sounds from heating or ventilation systems;
 3. sounds generated from equipment such as printers, telephones and copiers;
 4. white noise or purposely induced masking noise - generated electronically;
and
 5. sounds generated by the individuals in the office such as speech or radios.
- Noise levels can impact speech intelligibility or privacy. Speech intelligibility means that the individuals are able to clearly hear and understand information without interference from background noise. Speech privacy is when speech is not inhibited by the background noise.

What to Look For

Noise and/or other distractions (e.g., from printers or equipment, or other employees). Individuals will often complain that the background noise interferes with their ability to concentrate or is distracting, communication or causes fatigue. You may answer the question in two ways. First, ask the employee about his/her perception of noise. Check off the appropriate responses. Second, review the relevant portions of the AFOSH STD 48-19, Chapter 2, although noise levels in office environments are expected to be lower than established legal limits.

References: 23, 47, 48

Table 28
Checklist Question 28

Question: Extreme Temperatures - chronically low or high temperatures or extreme fluctuation.			
Targeted Risk Factors			
Risk Factors		Risk Factors	
	Excessive Noise	x	Extreme Temperatures
	Static Work Postures		Poor Air Quality
Background and Discussion			
Most individuals feel comfortable in an office environment when the air temperature is between 68° - 76° F or 20 - 26° C. The normal body temperature is 98.6° F (37° C). In the summer, skin temperature is around 95° F (37° C) and in the winter is approximately 91.4° F (33° C). Properly adjusted HVAC systems should allow body heat to dissipate at a controlled rate. Poor temperature or ventilation control contributes to fatigue and discomfort. It is difficult to adjust HVAC systems to keep all individuals comfortable since heat output varies between individuals and comfort is subjective.			
What to Look For			
Extreme temperatures chronically low or high temperature or extreme fluctuation in temperature in the office environment. Individuals may complain of being too cold or too hot affecting their ability to concentrate or increasing their feeling of fatigue especially when the individual feels too warm. Ask the employee to help you rate this risk factor based on their perception. If the employee comments that the temperature is “always” a problem or that the temperature reaches extreme, mark the “strongly agree” response. If the employee simply states that temperature is “sometimes” a problem, mark the “agree” response.			
References: 24, 49			

Table 29
Checklist Question 29

Question: Indoor air quality (IAQ) concerns.

Targeted Risk Factors

Risk Factors		Risk Factors	
	Excessive Noise		Extreme Temperatures
	Static Work Postures	x	Poor Air Quality

Background and Discussions

The air quality issue is complex. Office buildings can contain a number of pollutants or contaminants. Contaminants in the office environment can include increased levels of carbon dioxide (over 500 ppm); formaldehyde; tobacco smoke; carbon monoxide; allergens (molds and fungi); asbestos; ozone; and, respirable suspended particulates. Most odors do not indicate a hazardous condition. However, they may be a signal of the presence of a chemical or air contaminant. Lack of fresh air is a common problem in office buildings. Ventilation systems which introduce at least 10% fresh air (rather than recirculated air) is recommended. Poor air quality will affect comfort and performance of office workers and less frequently the health of building occupants.

What to Look For

Individuals may complain of discomfort and poor health (e.g., headaches and fatigue.) These symptoms may be caused by a number of factors which may not include air quality problems. They may, however, signal air quality concerns, indicating the need to evaluate air quality and ventilation system performance. Ask the employee to help you rate air quality concerns or a detailed evaluation of the IAQ by BEF may be indicated.

References: 24, 50

Table 30
Checklist Question 30

Question: Restricted Space.

Targeted Risk Factors

Risk Factors		Risk Factors	
	Excessive Noise		Extreme Temperatures
x	Static Work Postures		Poor Air Quality

Background and Discussions

Restricted space is not the same as “confined space.” The design of the work surface should allow for adequate placement of equipment and materials related to the task within easy reach. Adequate work surface space and storage should be provided to accommodate equipment, materials and items used to perform the job throughout the work day. If adequate space is not provided, the individual may have difficulty performing the task. Productivity may also be compromised.

What to Look For

Space often becomes restricted when new equipment is introduced, but the space allocated is insufficient to house the equipment and storage of personal items/files/equipment is relegated to the area under the work surface. For example, in the case in the introduction of a new computer to a work surface with a depth of 24 inches (61 cm), the desk may accommodate the keyboard and monitor, but with monitor at a horizontal distance of 16 inches (40.6 cm) from the eye. Individuals may compensate by positioning the monitor off to one side not directly in front of the individual requiring the individual to twist the neck, upper and lower back. The under surface of the desk may also be restricted by personal items or the position of file boxes restricting forward leg room.

References: 51

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**SAMPLE LEVEL I ERGONOMICS
ASSESSMENT CHECKLIST**

Level I Ergonomics Assessment Checklist for Administrative Work Areas	Survey Date (YYMMDD) 96-10-14	Workplace Identifier:	
<i>(use this space for mechanical imprint)</i>	Base Wright-Patterson AFB, OH		Organization
	Workplace Contracts		
	Bldg. No/Location	Room/Area	
	AFSC/Job Series Contract Specialist		
	Job Name:		
BEF Technician: _____ Sign			

Level I Ergonomics Assessment for Administrative Work Areas

Part I - Work Content (Description of Tasks Performed)

Technician:

E-Technician

Date:

14 October 1996

For this section, work with the employee to obtain a basic description of the types of tasks that make up his/her job. For each Type of Work performed, indicate the approximate work frequency by checking the most appropriate circle.

1. **Routine:** Performed *three or more days per week*.
 - **1-4 hrs.:** The total amount of time per day spent performing the task is 1-4 hrs.
 - **> 4 hrs.:** The total amount of time per day spent performing the task is more than 4 hrs.
 - **< 1 hr.:** The total amount of time per day spent performing the task is less than 1 hr.
2. **Non-routine:** Performed two days a week or less.
3. **Never/NA:** This type of work not performed

WORK CONTENT MATRIX

Task <i>If the employee performs tasks which are not listed, write in the additional task types and indicate the work frequency.</i>	Work Frequency (Check one)				
	Never/NA	Non-Routine	Routine		
			< 1 hr.	1-4 hrs.	> 4 hrs.
1. Using a computer - General/word processing	☐	☐	☐	☒	☐
2. Writing/Reviewing documents	☐	☐	☐	☐	☒
3. Stapling	☐	☐	☒	☐	☐
4. Monitoring (vigilance tasks)	☒	☐	☐	☐	☐
5. Calling (telephone use)	☐	☐	☒	☐	☐
6. Copying	☐	☐	☒	☐	☐
7. Drafting/illustrating (CAD/graphics)	☒	☐	☐	☐	☐
8. Filing/general administrative	☐	☐	☒	☐	☐
9. Lifting	☒	☐	☐	☐	☐
10. Use of calculator/numerical pad	☐	☐	☒	☐	☐
11. Microscope	☒	☐	☐	☐	☐
12.	☐	☐	☐	☐	☐
13.	☐	☐	☐	☐	☐
14.	☐	☐	☐	☐	☐

 = Only complete the checklist for critical tasks which are indicated by the shaded box. [Critical tasks include: Routine tasks and Lifting tasks (regardless of frequency)]

Performance Measures

How is your performance measured? Promotion and raises are based on low error rates. project completed on time, customer satisfaction. However, the evaluation process is not formal.

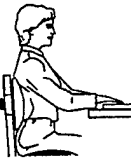
Part II - Checklist, Shoulder / Neck

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if BOTH
 - Task is performed greater than 4 hours per day AND
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur OR is not applicable.

Critical Tasks

	Job Factor	Task Computer 1-4	Task Writing >4	Task	Task	Comments
	1. Upper arms held away from body continuously while unsupported greater than 15° away from the body (e.g., using keyboard, mouse).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	2. Repeated reaching arms greater than 15° away from the body, (e.g., obtaining reference manuals, filing, accessing telephone).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	Reaching for manuals on high shelves while sitting
	3. Shrugging working with both shoulders raised while arms unsupported (e.g., keyboard too high).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	Keyboard seems too high
	4. Repeated arm forces exceeding 10 lb. (4.5 kg.) (roughly equivalent to lifting a gallon of milk), (e.g., pulling files or stapling).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	5. Holding/carrying materials exceeding 25 lb. (11.3 kg.) (e.g., 10" stack of files).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	6. Cradling the telephone between the neck and shoulder	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	7. Head bent down, up, or neck is twisted (e.g., monitor or document too high, too low, off to side).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)	2	6			

Part II - Checklist, Hands/Wrists/Arms

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if BOTH
 - Task is performed greater than 4 hours per day AND
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur OR is not applicable.

Critical Tasks

	Job Factor	Task Computer 1-4		Task Writing >4		Task		Task		Comments
		F=4	S=1	F=4	S=1	F=4	S=1	F=4	S=1	
	8. Bent Wrists (e.g., any instance when wrist is not straight.)	N=0		N=0		N=0		N=0		
	9. Repeated Wrist Movements (e.g., manipulating paper.)	N=0		N=0		N=0		N=0		
	10. Repeated Finger Movements (e.g., using keyboard, mouse, paper/equip.)	N=0	S=1	N=0		N=0		N=0		
	11. Hyperextension of Finger/Thumb. Finger/thumb held away from rest of hand (e.g., using small input devices)	N=0		N=0		N=0		N=0		
	12. Hand Forces more than minimal force used to key, constant pinch force > 2 lb. (0.9 kg.) (e.g., squeeze staple remover, hitting keys, gripping mouse or pencil, pulling files) constant full-hand force > 5 lb. (2.3 kg.) (e.g., hold gallon of water.)	N=0		N=0	S=1	N=0		N=0		
	13. Hard Edges wrists or forearms rest on hard edges (e.g., desk, keyboard tray, armrests.)	N=0		N=0		N=0		N=0		
	14. Repeated Forearm Rotation (e.g., flipping pages.)	N=0		N=0		N=0		N=0		
	Task Scores = (column total)	1		2						

Part II - Checklist, Back/Torso

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if BOTH
 - Task is performed greater than 4 hours per day AND
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur OR is not applicable.

Critical Tasks

	Job Factor	Task <i>Computer</i> 1-4	Task <i>Writing</i> >4	Task	Task	Comments
	15. Leaning Forward or Poor Lower Back Posture (e.g., when sitting, when standing)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	Can't get close enough - Materials under desk
	16. Repeated Bending while standing > 45° forward bending or any observable leaning to the side, twisting or backward bending, (e.g., lifting below knee height)	F=4 S=4 N=0	F=4 S=4 N=0	F=4 S=4 N=0	F=4 S=4 N=0	
	17. Lifting Forces — handling > 50 lb. (22.7 kg.) while close to body or, — handling > 10 lb. (4.5 kg.) While bent and/or reaching (or while seated) or — high speed movements	F=4 S=4 (any duration) N=0	F=4 S=4 (any duration) N=0	F=4 S=4 (any duration) N=0	F=4 S=4 (any duration) N=0	
	18. No Foot Support When sitting, feet cannot rest flat on the floor (e.g., feet dangling, feet tucked back, legs crossed, sitting on leg, etc.)- or foot support not used.	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)	0	5			

Part II - Checklist, Legs/Feet

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

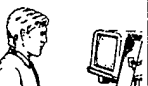
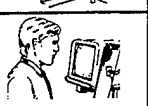
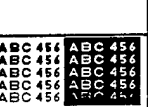
- **Frequently (F):** if BOTH
 - Task is performed greater than 4 hours per day AND
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur OR is not applicable.

Critical Tasks

	Job Factor	Task Computer 1-4	Task Writing >4	Task	Task	Comments
	19. Edge of Seat or work surface presses into legs.	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	20. Hard Floor Surface Standing and/or walking on hard surfaces.	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	21. Kneeling/Squatting	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)	0	0			

Checklist, Head/Eyes

Critical Tasks

	Job Factor	Task Computer 1-4	Task Writing >4	Task	Task	Comments
	22. Staring at Screen or Document	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	23. Glare (e.g., on computer screen, work surface, from overhead lights/windows)	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	24. Light Levels too high or too low	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	25 Screen Distance too far away(>30")(>76.2cm) or too close(<18")(<45.7cm)	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	26. Difficult to Read Computer screen/documents are difficult to read (e.g., text too small, poor display quality)	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	Task Scores = (column total)	2	2			

Part III - Environmental

Environmental Factors

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
27. Noise and or other distractions (e.g., from printers or equipment, other employees)	0	0	0	1	4
28. Extreme Temperatures Chronically low or high temperature or extreme fluctuation	0	0	0	1	4
29. Air Quality Concerns	0	0	0	1	4
30. Restricted Space	0	0	0	1	4

Environmental Score = 6

Environmental Rating	Low	Med	High
Environmental Score	0-3	4-7	8+

Part IV - Employee Suggestion

Ask the employee for any suggestions for corrective actions that they may have.

Employee mentioned that there was not enough space and that a new chair might help.

Employee also suggested reducing the airflow in the area since it creates a draft.

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APPENDIX 3

Prioritization of Hazards

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APPENDIX 3

This Appendix corresponds with Step 3: Prioritization of Hazards. It provides a completed example of a Checklist Scoring Summary form.

SAMPLE CHECKLIST SCORING SUMMARY

CHECKLIST SCORING SUMMARY

Technician _____ (Name) _____

Date (Date of Analysis) _____

1. Job Description: Please write out job description.

Management of Air Force contracts is accomplished by reviewing files, entering data in computer, validating information in the contract, and filing. The contract specialist must meet with others in the immediate work area.

2. Scoring Summary: Transfer scores from individual scoring sheets.

Body Region	Task Scores				Priority Score by Body Region	Priority Rating by Body Region
	Task Name: Computer	Task Name: Writing & Reviewing	Task Name:	Task Name:	Add across row and divide by # of tasks for average	High: 8+ Med: 4-7 Low: 0-3
<u>Shoulder/Neck</u>	2	6			= 4	High Med Low
<u>Hand/Wrist/Arm</u>	1	2	* Note: 1.5 was rounded up to 2		= *2	High Med Low
<u>Back/Torso</u>	0	5	* Note: 2.5 was rounded up to 3.		= *3	High Med Low
<u>Legs/Feet</u>	0	0			= 0	High Med Low
<u>Head/Eyes</u>	2	2			= 2	High Med Low

Select the highest body region score for each task then circle below for High, Med, Low	Highest Score	Highest Score	Highest Score	Highest Score
	2	6		
High: 8+ Med: 4-7 Low: 0-3	High Med Low	High Med Low	High Med Low	High Med Low

Environmental Rating
High Med Low

3. Case Study Selection: Select the case studies that match the high or medium rated tasks that you identified for this job. Place a ✓ in the appropriate boxes below and then turn to the appropriate case study in Appendix 4.

CASE STUDIES		
1. Use of Computer • Keying/Typing • Mousing	5. Calling (Telephone Use) ☐	9. Use of Calculator/ Numeric Keypad ☐
2. Writing/Illustrating ☒	6. Copying/Sorting ☐	10. Lifting/Pushing/Pulling ☐
3. Stapling ☐	7. Drafting (CAD Systems) ☐	11. Microscope Work ☐
Monitoring Visual Display (Vigilance) ☐	8. Filing/Administrative ☐	

Overall Job Priority Score	
Highest Avg. Score by Body Region 4	High Med Low
Body Region Shoulder/Neck	

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APPENDIX 4

Hazard Control Section

APPENDIX 4

Case Study Problem-Solving Matrices for Administrative Work Areas.

This Appendix includes:

- a sample completed Corrective Actions List; and
- 11 case studies.

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**CORRECTIVE ACTION LIST
(ADMINISTRATIVE WORK AREAS)**

Select the corrective action from the **case studies** pages paying particular attention to the body regions that are primary and secondary concerns. Place a ✓ in the appropriate boxes below as you select from each case study.

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
1. Alternate between sitting and standing			
2. Alternate grips for pen to help reduce gripping force			
3. Angle telephone base slightly			
4. Angle work surface to bring work closer to the body and the eye			
5. Center numeric pad or calculator in front of body			
6. Check eyes and correct for visual disorders			
7. Clean screen regularly			
8. Close blinds or curtains			
9. Cover or turn out under cabinet lighting			
10. Direct task light away from screen and eyes			
11. Group frequently used items together for convenient retrieval			
12. Improve character size and style on document and monitor			
13. Incorporate health comfort strategies • alternate tasks • stretch • take rest pauses			A.5.2.1
14. Install adjustable forearm rest			
15. Install alternative mouse			
16. Install anti-glare screen		X	
17. Install larger keyboard tray			
18. Install palm rest		X	A.5.2.6

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
19. Install palm support entire length of drafting table			A.5.2.6
20. Install parabolic louvers to direct light down on the surface		X	
21. Install push button phone			
22. Investigate use of alternative calculator/keyboard			A.5.2.9
23. Kneel to access lower level of photocopier			
24. Kneel to access low level shelves			
25. Locate frequently retrieved items between knee and shoulder height			
26. Locate heavy items between knee and waist level			
27. Locate sorting piles near work surface edge			
28. Lower chair			A.5.1.4
29. Lower items below shoulder height			A.5.1.3
30. Lower keyboard tray or work surface	X		
31. Lower light levels			A.5.1.5
32. Lower sort shelves below shoulder height			A.5.1.4
33. Move chair closer to surface edge			
34. Move items closer to body			
35. Move items in work zone	X		
36. Move keyboard forward so forearms rest evenly on surface			
37. Move microscope closer to edge			

Corrective Action List (Administrative Work Areas) Cont'd

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
38. Move microscope forward so forearms rest evenly on surface			
39. Move monitor from underneath shelves			
40. Move monitor out from under cabinet lighting			
41. Move mouse/keyboard forward so forearms rest evenly on surface			
42. Move stapler closer to work surface edge			
43. Move telephone in work zone			
44. Orient paper by turning it so that area worked in is close to the body			
45. Periodically look away from microscope to change the task demand on the eye and focus on an object of varying distance			
46. Periodically look away from screen.			
47. Place binders on work surface			
48. Place hand when not dialing on worksurface or lap.			
49. Place keyboard and mouse on work surface			
50. Place keyboard/calculator /monitor onto larger surface			
51. Place microscope on larger surface			
52. Place monitor on alternative work surface			
53. Place monitor perpendicular to window			
54. Position body closer to work			

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
55. Position desk perpendicular to the window			
56. Position document at a comfortable viewing distance for larger blue prints by folding document or loosely rolling			
57. Position document on document support same height and angle as monitor. If document is handled, flipped or written on, a slightly inclined surface is preferred. Place document on side of dominant eye.	X		A.5.1.5
58. Position monitor 18 - 30 " (45.7 - 76.2 cm.) from eyes			A.5.1.5
59. Position monitor appropriately. -For drawing work, so that eye level is at mid-screen . - For non-drawing tasks, the primary work area on the screen should be just below eye level. - For bifocal user, so that the neck is upright, not tilted (usually directly on the work surface) • place on monitor blocks • place monitor on hard drive • place monitor on work surface	X		A.5.1.5
60. Position monitor between overhead lights			
61. Position monitor in front of body			
62. Position monitor so eyes are mid level on screen			A.5.1.5

Corrective Action List (Administrative Work Areas) Cont'd

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
63. Position mouse next to keyboard	X		
64. Position mouse next to keyboard at same height			
65. Position numeric pad in front of monitor			
66. Position tablet in primary zone			A.5.2.2
67. Program macro keys to reduce keying			
68. Properly maintain carts			
69. Provide additional staff			
70. Provide adequate storage			A.5.2.3
71. Provide alternative work surface layout			A.5.2.2
72. Provide anti-fatigue mats			
73. Provide appropriate cart			
74. Provide appropriate document holder			A.5.2.5
75. Provide back support			
76. Provide footrest			A.5.2.4
77. Provide larger work surface		X	A.5.2.2
78. Provide proper chair			A.5.2.1
79. Provide screen hood/visor		X	
80. Provide standing work station			
81. Provide stapler with longer, level arm			
82. Provide task light			A.5.2.8
83. Provide telephone headset			
84. Raise arm rest(s)			A.5.1.4
85. Raise chair	X		A.5.1.4
86. Raise desk with 1 - 2 " blocks"			
87. Raise keyboard or work surface			A.5.1.3
88. Redesign job			

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
89. Remove clutter from under work surface			
90. Remove or lower armrests			A.5.1.4
91. Rotate staff members between tasks			
92. Stand up and reach for items positioned above desk or in reference zone.	X		
93. Tilt monitor down so it is parallel to floor	X		A.5.1.5
94. Train worker to properly adjust chair	X		
95. Train proper body mechanics/posture			
96. Train proper keying style	X		
97. Train proper microscope technique			
98. Train proper mousing style			
99. Train use of available footrest			
100. Use a flat staple remover with a power grip rather than a pinch grip			
101. Use an available telephone headset			
102. Use automatic stapler			
103. Use available alternative work surface			
104. Use available cart to move boxes, files etc.			
105. Use available chair with adjustable armrest(s) for forearm support			A.5.1.4
106. Use height adjustable armrests to support the forearm			A.5.1.4
107. Use keyboard tray that accommodates mouse, keyboard and palm support			

Corrective Action List (Administrative Work Areas) Cont'd

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
108. Use Larger stapler with longer level arms			
109. Use proper cart to move files			
110. Use proper footwear			
111. Use step stool to access high level shelves			
112. Use task specific lens			
113. Use well-fitting gripper gloves to pull files			

Environmental Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
1. Close doors when possible to reduce noise	X		
2. Complete a space plan			
3. Eliminate/reduce loud radios, p.a. announcements and phone signals (ringers)			
4. Install acoustical panels		X	
5. Install printer covers to isolate noise			
6. Install separate air conditioning units when possible			
7. Install wall panel(s)			
8. Minimize clutter on desk/			

Environmental Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
worksurfaces			
9. Open doors/windows when possible			
10. Provide adequate storage			
11. Provide portable fan(s)			
12. Provide portable heater(s)			
13. Rearrange desk/worksurfaces			
14. Rearrange workarea to avoid face-to-face workstations			
15. Redesign work areas			
16. Redirect air conditioning units and/or fans		X	
17. Relocate workstation away from air vents		X	
18. Remove unnecessary boxes from workareas and/or walkways			
19. Use air-conditioning when provided			
20. Use heavier clothing when possible			
21. Use lighter clothing when possible			
22. Vent portable air conditioners and other heat producing equipment to outdoors when possible			

CASE STUDY PROBLEM-SOLVING MATRICES

The 11 case study problem-solving matrices provided on the following pages link the problems identified with the Level I Ergonomics Assessment Checklist and Checklist Scoring Summary to strategies or options which you may use to control ergonomics hazards. The matrices and the pages on which they appear are presented in Table 1 below.

Table 1
Directory of Case Study Problem-Solving Matrices

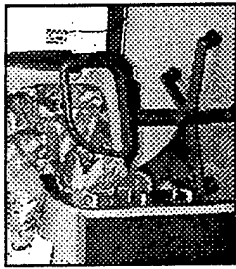
Case Study	Page No.
Case Study 1: Using a Computer/General Word Processing • Keying/Typing • Mousing	3-51
Case Study 2: Writing/Illustrating	3-69
Case Study 3: Stapling	3-81
Case Study 4: Monitoring Visual Displays (Vigilance)	3-89
Case Study 5: Calling (Telephone Use)	3-107
Case Study 6: Copying/Sorting	3-115
Case Study 7: CAD System Use (Drafting)	3-123
Case Study 8: Filing/General Administrative	3-137
Case Study 9: Use of Calculator/Numeric Key Pad	3-145
Case Study 10: Lifting/Pushing/Pulling	3-157
Case Study 11: Microscope Work	3-165

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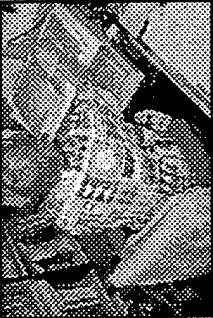
CASE STUDY - 1 Using a Computer/General Word Processing

TASK TITLE: Keying/Typing		TASK TITLE: Mousing
Task Description:		Task Description:
Typing and keying may involve the use of a computer keyboard or electronic typewriter. The types of keyboards on which this case study is based is that of a Qwerty layout; conventional rectangular design. The length of time keying varies significantly for keying/typing tasks as well as the type of work that is typically performed. Information used for keying/typing may come from a hard copy, Dictaphone, or telephone. Typical jobs in which keying is performed include (not necessarily limited to): • heavy data entry • customer service/record keeping • general administrative support		Mousing involves the use of a standard-shaped mouse. The mouse fits into the palm and is activated by either two or three buttons. Mousing can also be performed on a laptop with the use of a small button or track ball. Mousing is used to point and click on an object on the screen, scroll on a series of lines, or draw. The length of time mousing varies significantly for mousing tasks as well as the type of work that is typically performed. Information used for mousing typically comes from a hard copy. Typical jobs in which mousing is performed include: • desktop publishing • technician/administrative tasks
Job Performance Measures Most often impacted by Using a Computer:		Error rates; number of records/documents processed.
Typical Employee Comments about Using a Computer:		Employees most often comment on their concern over the repetitive nature of the keying, and/or mousing tasks. A great deal of media attention is given to keying and this seems to bring the employee's attention here. For both keying and mousing, employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, shoulders/neck, and head/eyes.
Suggested Level II Analysis:		Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	Keyboard too high  Figure 1.1	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; - Note: in some cases, a footrest will be required in order to support the person's feet.	✓		low	low	low
		30. Lower keyboard tray or work surface: set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓		low to med	low	med
		33. Move chair closer to work surface.	✓		low	low	low
	- Chair positioned too far away - Arms of chair interfere with moving chair closer.  Figure 1.2	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	low	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	low	low

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Lack of a place to rest the hands.  Figure 1.3	36. Move keyboard forward so forearms rest evenly on surface; if worksurface is deep enough, this is simply a matter of pushing the keyboard back on the worksurface; if the worksurface depth is restricted, providing this space would require using a different worksurface for computer work.	✓		low	low	low
	Lack of leg clearance under desk.	89. Remove clutter from under work surface.	✓		low	low	med
	Mouse positioned too high.  Figure 1.4	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the mouse; - Note: in some cases, a footrest will be required in order to support the person's feet.	✓		low	low	low
		30. Lower keyboard tray or work surface: set the height of the mouse support surface so that the person's elbows are at the same height as the mouse.	✓	✓	low to med	low	med

Case Study 1 (continued)

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			Minor Modification	Major Change		Quality	Productivity
	Mouse not positioned next to keyboard.  Figure 1.5	63. Position mouse next to keyboard: provide a worksurface that allows the mouse and keyboard to be placed side by side and at the same height; position mouse and keyboard so the forearm can be rested on the worksurface while keying and mousing.	✓	✓	low to med	low	low
	Keyboard tray used with mouse placed on desk.  Figure 1.6	17. Install larger keyboard tray: replace the current keyboard tray with a tray which accommodates a mouse/input and a keyboard. 49. Place keyboard and mouse on work surface: provide a worksurface which is large enough to support a keyboard and mouse.		✓	med	low	med
	Items used frequently not positioned close to the body.	35. Move item in work zone: items which are used every few minutes or more should be placed close to the body	✓		low	low	med

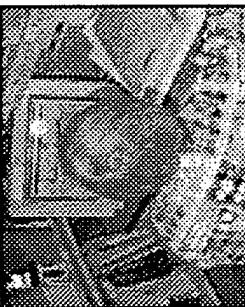
Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Repeated reaching	Reaching for items too far from body.  Figure 1.7	35. Move items in work zone.	✓		low	low	med
3. Shrugging: working with the shoulders shrugged	- Keyboard too high - Chair positioned too low - Drawer under work surface restricts chair height	30. Lower keyboard tray or work surface: set the height of the work surface so that the person's elbows are at the same height as the keyboard. 85. Raise chair: set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; Note: in some cases, a footrest will be required in order to support the person's feet. 71 Provide alternative work surface: remove drawer; provide a workstation with no obstructions under the work surface such as pencil drawers or structural brackets.	✓		low to med	low	med
			✓		low	low	low
			✓		med	low	med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person has tendency to tense the shoulders while working	23. Incorporate health comfort strategies: - encourage the person to relax while working - breath frequently - alternate tasks - stretch - take rest pauses 95. Train proper body mechanics/posture: - encourage the person to let the shoulders drop down and relax while keying.	✓		low	low	med
4. Repeated arm Forces	Rarely occurs	N/A					
5. Holding/carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulder	Talking on the telephone (using a headset) while both hands are occupied (e.g., keying or doing paper work)	83. Provide telephone headset: provide a selection of head set types to choose from (e.g., over-the-head, over-the-ear).		✓	med	med	med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		101. Use an available telephone headset	✓		low	med	med
	• Monitor positioned too low  Figure 1.8	59. Position monitor just below eye level: • raise the monitor; • monitor should be positioned such that the top of the screen is between 0-4" (0-10.16 cm) below eye height; • use a monitor riser, CPU/hard drive, or other stable surface to position monitor at the correct height	✓		low	low	med
	• Monitor positioned too high  Figure 1.9	59. Position monitor just below eye level: • lower the monitor; • monitor should be positioned such that the top of the screen is between 0-4" (0-10.16 cm) below eye height; • use a monitor riser, CPU/hard drive, or other stable surface to position monitor at the correct height	✓		low	low	low
				✓		low	low

Shoulder/Neck (cont'd)

Job Factor	Potential wazzu Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
7. Head Bent down, up, or neck twisted	• Monitor and keyboard not aligned  Figure 1.10	61. Position monitor in front of body: • position monitor so that it is directly behind the keyboard; this allows the body to be in alignment and prevents twisting of the neck; • provide a workspace that is deep enough to support the keyboard and the monitor screen. For large monitors, this indicates a workspace which is at least 30" (76.2 cm) deep;	✓		low	med	med
		77. Provide a workspace that is large enough for computer and paper tasks; Caution: white keyboard trays and monitor support arms can be used in some situations, they often have unwanted side effects.		✓	med to high	med	med
		34. Move items closer to body: • position monitor between 18" and 30" (76.2 cm) from eyes; • 22"-24" (55.88 - 60.96 cm) is a good distance for many people.	✓		low	med to high	med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Uncorrected visual disorders cause the person to lean forward to read monitor or documents. - Individual wears bifocals.	6. Check eyes and correct for visual disorders: - encourage person to have visual disorders corrected. 6. Check eyes and correct for visual disorders: - provide monofocal or tri-focal computer glasses. 59. Position monitor directly on the work surface: - for bifocal users, place monitor directly on the work surface or a bit higher so that the head is upright not tilted back (caution: make sure that this does not cause glare problems. If it does, computer glasses are a better solution).	✓		med to high	med to high	high
				✓	med to high	med	med
				✓	low	med	med

Case Study 1 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	• Keyboard/typewriter too high • Worksurface too high. • Keyboard is above elbow height	30. Lower work surface/keyboard tray: • if the worksurface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; this is the preferred strategy because it doesn't require a foot rest. 85. Raise chair: • set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; • This strategy is best when the worksurface is not easily adjustable in height. • Note: in some cases, a footrest will be required in order to support the person's feet.	✓		low to high	low	med
			✓		low	low	low
			✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Keyboard/typewriter too low. • Keyboard is below elbow height when chair height is adjusted so that the person's feet are flat on the floor	87. Raise keyboard or work surface: if the worksurface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; if the worksurface is not adjustable in height, try raising the entire workstation with risers. This works best for free standing furniture but often does not work for modular furniture; this is the preferred strategy because it doesn't require a foot rest.	✓		low	low	med
	• Keyboard is sloped towards the person.	49. Place keyboard and mouse on worksurface: • lower the feet on the back of the keyboard; • adjust the keyboard support surface so the keyboard is flat and level.	✓		low	low	med

Case Study 1 (continued)

Hands/Wrists/Arms

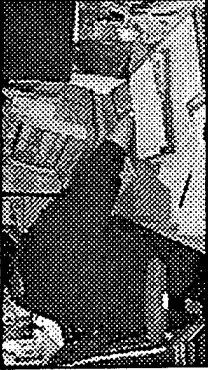
Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person rests wrists on front edge of the keyboard or the work surface immediately in front of the keyboard	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying ; - encourage person to avoid bending the wrists while resting the hands.	✓		low	med	med
		18. Install palm rest: a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture.	✓		low	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person constantly rests wrists on the wrist rest while keying	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying; - encourage person to use an arm movement to move around on the keyboard rather than a wrist movement; - encourage person to avoid bending the wrists while resting the hands when not keying; - rest hands in lap or on arm rests while pausing.	✓		low	med	med
		18. Install palm rest: - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; - generally, a palm rest which is approximately the same height as the keys will achieve this.		✓	low	med	med

Case Study 1 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Leaning forward while keying or using the mouse	95. Train proper body mechanics: - encourage person to rest the back against the back rest while keying or using the mouse; - this reduces the tendency to bend the wrists back while keying or using the mouse.	✓		low	med	med
	Position of mouse in relation to keyboard	107. Use keyboard tray that accommodates mouse, keyboard, and palm support.	✓		low to med	med	med
	Mouse is too far away from body	63. Position mouse next to keyboard: - position the mouse directly adjacent to the keyboard and at approximately the same height as the keyboard; - position mouse and keyboard so the forearm can be rested on the work surface while keying and mousing.	✓		low	low	low
	 Figure 1.11 Using wrist movement to move mouse rather than arm movement	95. Train proper body mechanics posture: encourage person to use a forearm movement to move the mouse rather than a wrist movement.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. Repeated wrist movements	Rarely occurs	N/A					
10. Repeated finger movements	Keying/typing speed	67. Program macro keys to reduce keying: - macros are small programs that can be useful for highly repetitive keying or mousing actions. 95. Train proper body mechanics posture: - encourage the person to avoid rushing. 13. Incorporate health comfort strategies: - alternate tasks; - stretch; - take rest pause. 88. Redesign job: - adjust job activities to distribute keying activities throughout the day; - break up continuous keying and mousing tasks with other types of tasks.	✓		low	high	high
	Length of task without a work break		✓		low	low	low
			✓		low	med	med
			✓	✓	low to med	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
11. Hyper-extension of finger/thumb	- Small input device (e.g., track ball, glide point) requires single finger activation - Person has tendency to hyperextend fingers or thumbs while keying.	15. Install alternative mouse - provide a full-size input device such as a mouse or large track-ball 98. Train proper mousing style: - encourage person to avoid extending fingers while mousing or keying; - encourage person to keep all of the fingers curled under and together.	✓	✓	low to high	low	med
			✓		low	low	low
12. Hand forces	Person tends to hit keys hard	96. Train proper keying style: encourage person to practice using as light a touch as possible on keys and buttons.	✓		low	low	low
	Person tends to place a heavy grip on mouse or click mouse buttons hard	98. Train proper mousing style: encourage person to practice keeping a light grip on the mouse.	✓		low	low	low
	Keys are stiff	22. Investigate use of alternative keyboard: - provide a keyboard with keys which do not require excessive forces to actuate; - keys should provide adequate auditory and tactile feedback when actuated.		✓	med to high	med	med

Case Study 1 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Mouse buttons are stiff.	15. Install alternative mouse: provide a mouse with buttons which do not require excessive forces to actuate.	✓	✓	med to high	med	med
	Lack of appropriate tactile feedback ("click").	22. Investigate use of alternative keyboard: keys should provide adequate auditory and tactile feedback when actuated.					
		15. Install alternative mouse: mouse buttons should provide adequate auditory and tactile feedback when actuated.		✓	low to high	med	med

Case Study 1 (continued)

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	Wrists rest on edge of work surface. (See Figures 1.12 and 1.13) Figure 1.12  Figure 1.13 	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse. - In some cases, a footrest will be required in order to support the person's feet. 30. Lower keyboard tray or work surface: - set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓	✓	low	low	low
			✓				
36. Move keyboard forward so forearms rest evenly on surface:	- reduces the tendency to rest the wrists/forearms on the hard edge; - if the worksurface depth is restricted, providing this space would require using a different worksurface for computer work.		✓		low	low	low
				✓			

Case Study 1 (continued)

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		18. Install palm rest: - the hard edge can be eliminated by attaching a rounded edge to the front edge of the worksurface. This option is generally preferred over the use of a palm rest; - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; - a palm rest is not recommended for a mouse because it results in awkward wrist movements.	✓		low	med	med
	Work surface is not deep enough to provide a place to rest the hands in front of the keyboard	107. Use keyboard tray that accommodates mouse, keyboard, and palm support.		✓	high	med	med
	Hard arm rests	77. Provide larger work surface. 94. Train worker to properly adjust chair: attach padding to the armrests to eliminate exposure to hard edges.	✓	✓	med to high	med	med
		78. Provide proper chair provide a chair with padded armrests		✓	low	low	low
					med	low	low

Case Study 1 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
14. Repeated forearm rotation	Rarely occurs	N/A					
15. Leaning forward or poor lower back posture	- Monitor too far from eyes - Text is difficult to read	58. Position monitor 18" - 30" (33.02-76.02) from the eyes; is a good distance for many people. 12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point is recommended for screen distances of 18"-30" (33.02-76.02 cm); - font sizes of greater than 12 point are recommended for screen distances greater than 30" (76.02 cm). 95. Train proper body mechanics: - encourage person to rest the back against back rest and sit back and relax while working; encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	med	med
	Person has the unconscious habit of leaning forward while working		✓		low	med	med

Case Study 1 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inappropriate chair adjustment	94. Train worker to properly adjust chair: - adjust back rest to support lower back; - pull chair forward and lean back while working; - attach a small pillow to back rest to support lower back.	✓		low	med	med
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med to high	med	med
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	med	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	med	med

Case Study 1 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Seat pan on chair is too deep.	75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med	med	med
	- Inadequate foot support causes person to not lean against back rest. - Chair too high discourages person from leaning against back rest	76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a box or several ring binders taped securely together can also be used; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests with several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of 16" x 20" (40.64 X 50.8 cm) is recommended).	✓		low to med	low	low
				✓	low to med	low	low

Case Study 1 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
16. Repeated bending	Reaching for items too far from body  Figure 1.14	35. Move items in work zone.	✓		low	med	med
17. Lifting forces	Rarely occurs	N/A					
18. No foot support	Chair too high.	28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low

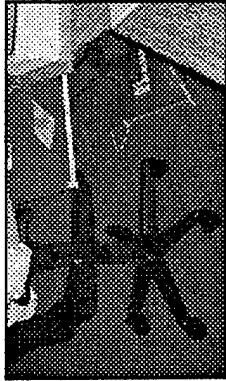
Case Study 1 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Feet are unsupported	76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests with several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64cm X 50.8 cm) is recommended).	✓		low to med	low	low

Case Study 1 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or worksurface presses into legs	Feet are not supported	76. Provide footrest: - a footrest can support the feet and simultaneously reduce pressure on the back of the leg; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests with several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64cm X 50.8cm) s recommended).  Figure 1.15	✓		low to med	low	low

Case Study 1 (continued)

Legs/Feet (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓	✓	low	low	low
	Seat pan has a hard front edge	94. Train worker to properly adjust chair: provide a cushion for the seat pan to prevent contact with hard edge.	✓		med	low	low
		78. Provide proper chair: provide a chair with a rounded front edge on the seat pan.		✓	med to high	low	low
	Seat pan too long	75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓	✓	med	low	low
				✓	med to high	med	med

Case Study 1 (continued)

Legs/Feet (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Obstructions under worksurface interfere with leg clearance and expose person to hard edges - pencil drawers - keyboard trays - or structural supports	89. Remove clutter from under work surface: - eliminate obstructions; - remove pencil drawers; - replace problem keyboard trays with trays that do not expose person to hard edges.	✓		low to high	med	med
20. Hard floor surfaces	Rarely occurs	N/A					
21. Kneeling/squatting	Rarely occurs	N/A					

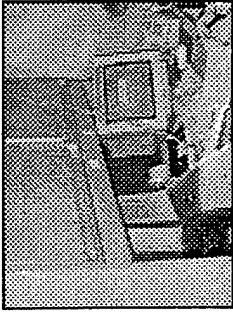
Case Study 1 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Length of work task without a change of position for the eyes	46. Periodically look away from screen. 13. Incorporate health comfort strategies: - alternate tasks; - stretch; - take rest pauses.	✓		low	low	low
23. Glare	- Glare directly from a light source: looking towards an uncovered window - Glare from an uncovered window reflected off monitor or other shiny surfaces  Figure 1.16	53. Place the monitor perpendicular to the window. 8. Close blinds or curtains provide window coverings if not available.	✓		low to med	med	low

Case Study 1 (continued)

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Task light shines into eyes  Figure 1.18	9. Cover or turn out under-cabinet lighting: - cover the task light to prevent it from shining into eyes. 40. Move monitor out from under-cabinet lighting. 10. Direct task light away from screen and eyes: - if necessary, provide a more easily adjustable task light.	✓		low	low	low
			✓		low	low	low
			✓		low	med	med
					low	low	low

Case Study 1 (continued)

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			Minor Modification	Major Change		Quality	Productivity
24. Light levels	• Light levels too high around monitor • Light level too low to read document	31. Lower light levels: • turn off task light; • 20-50 fc is an appropriate range of light levels for computer tasks; • remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area; • provide alternative light fixtures for overhead lights (parabolic louvre fixtures are recommended when computer work is the pre-dominant activity.) Note: this should also be performed by the appropriate personnel; • if light levels for the monitor are adjusted appropriately, it may still be necessary to increase light levels for paper tasks using a task light/desk lamp.	✓	✓	med to high	med	med

Case Study 1 (continued)

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
25. Screen Distance		82. Provide task light: - provide task light (50-100 fc is an appropriate range of light levels for reading tasks); - increase overall light levels to meet the lighting needs of computer and paper tasks (50 fc is an appropriate light level where both computer and paper tasks are performed).	✓	✓	low to med	med	med
	Monitor positioned too close to eyes	58. Position monitor 18" -30" (45.72 -76.2 cm) from the eyes: 22"-24" (55.88-60.96 cm) is a good distance for many people.	✓		low	med	med
	Not enough work surface space to position monitor far enough away from person	52. Place monitor on alternative work surface.		✓	med	med	med
	Monitor positioned too far from eyes	58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: 22"-24" (55.88-60.96 cm) is a good distance for many people.	✓		low	med	med

Case Study 1 (continued)

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Uncorrected visual disorders	6. Check eyes and correct for visual disorders and provide computer glasses for person's who need bifocals. Provide monofocal or tri-focal computer glasses.	✓	✓	med to high	med	med
26. Difficult to read	Font/character size too small to read on computer screen	12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point are recommended for screen distances of 18"-30" (45.72-76.2 cm); - font sizes of greater than 12 point are recommended for screen distances of greater than 30" (76.2 cm).	✓		low	med	med
	Document text too small	12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point are recommended for screen distances of 18"-30" (45.72-76.2 cm); - font sizes of greater than 12 point are recommended for screen distances of greater than 30" (76.2cm).	✓		low	med	med

Case Study 1 (continued)

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Document text hand written hard to read	12. Improve character size and style on document and monitor: increase character size.		✓	low to high	med	med
	VDT screen dirty.	7. Clean screen regularly.	✓		low	med	med

Case Study 1 (continued)

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CASE STUDY - 2 Writing/Illustrating

TASK TITLE: Writing/Illustrating

Task Description:

Writing and illustrating may involve the pen, pencil, or feltpen. The diameter of the pen/pencil/felt pen can vary in diameter from 1/4" (.635 cm) to 1" (2.54 cm). The length of time writing or illustrating varies significantly as well as the type of work that is typically performed. Writing and illustrating can be performed on a flat surface or an angled/height-adjustable drafting table.

Typical jobs in which writing and illustrating is performed include:

- desktop publishing
- customer service/record keeping contracts

Job Performance Measures Most often impacted by Writing/Illustrating:

Error rates, number of records/documents processed

Typical Employee Comments about Writing/Illustrating:

Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, and shoulders/neck.

Suggested Level II Analysis:

Postural analysis, light level analysis.

Case Study 2 (continued)

Shoulder/Neck Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	- Holding up pages of a multi-page reference document  Figure 2.1 - Person reaches to write on document which is too far away on work surface - Person does not rest the hand while writing	57. Position document on document support: - provide a mechanical holder for pages; - separate pages in document so that pages can be viewed one at a time; - investigate electronic storage of documents.	✓		low to med.	low	med.
			✓		low	low	med.
				✓	high	med.	med.
		35. Move item in work zone: - move the document closer to the edge of the work surface; - items which are used every few minutes or more should be placed close to the body.	✓		low	med.	med.
		18. Install palm rest: - provide a place for the person to rest the hand while writing; - encourage the person to rest the hand while writing.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
- Chair positioned too far away - Arms of chair interfere with moving chair closer  Figure 2.2	- Lack of leg clearance under desk - Items used frequently not positioned close to the body	33. Move chair closer to surface edge.	✓		low	low	low
		90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓	✓	low to med.	med.	med.
		78. Provide proper chair in which the armrests can be adjusted or removed.		✓	med. to high	med.	med.
		89. Remove clutter from under work surface.	✓		low	med.	med.
		35. Move item in work zone: items which are used every few minutes or more should be placed close to the body.	✓		low	med.	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Repeated reaching	• Turning pages repeatedly • Moving documents repeatedly	57. Position document on document support: • provide a mechanical holder for pages; • separate pages in document so that pages can be viewed one at a time; • investigate electronic storage of documents.	✓		low to med.	low	med.
			✓		low	low	med.
				✓	high	med.	med.
	• Items used frequently not positioned close to the body	35. Documents requiring frequent page turning should be in the primary work zone; that is, it should not require a reach in order to turn the pages.	✓		low	med.	med.
		34. Move items closer to body: • prioritize the location of items on the workstation according to frequency of use; • those items which are more frequently used should be closer to the body and more easily accessible.	✓		low	med.	med.

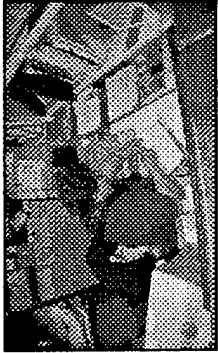
Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Too many documents or too much paperwork on the desk at one time	36. Move items closer to body: - prioritize the location of items according to frequency of use; - those items which are not used frequently should be filed or otherwise removed from the work surface to increase space for more frequently used items.	✓		low	med.	med.
	- Inadequate work space - Work surface inadequate space to support materials for required tasks	77. Provide a larger work surface: - provide a work surface which has adequate space for required tasks; - provide an auxiliary work surface; - go to a different area, which has a larger work surface for performing space intensive tasks; - increase the size of the existing work surface.		✓	med. to high	med.	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Chair positioned too low	85. Raise chair: - set the height of the chair so that the work surface is about half way between resting elbow height and shoulder height; - Note: in some cases, a footrest will be required in order to support the person's feet.	✓		low	low	low
3. Shrugging: working with the shoulders shrugged	Rarely occurs	N/A					
4. Repeated arm forces	Rarely occurs	N/A					
5. Holding/carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulders	Rarely occurs	N/A					
7. Head Bent down, up, or neck twisted	Reference document positioned flat on work surface (see Figure 2.5)	4. Angle work surface to bring work closer to the body and the eye: if document is manipulated frequently or written on, an	✓		med.	med.	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	 Figure 2.5	inclined work surface is preferred; - the inclined surface should be able to be moved easily and, preferably, adjustable in incline; - the inclined surface needs a stop at the bottom to hold papers; - the inclined surface can be a purchased accessory or it can be made by taping several empty 3-ring binders together and taping a clip board or a piece of card board at the bottom to hold papers.					
	Document is too far away or is too far to the side	34. Move items closer to body: - prioritize the location of items on the workstation according to frequency of use; - those items which are more frequently used should be closer to the body and more easily accessible.	✓		low	med.	med.
	Text is difficult to read	12. Improve character size and style on document and monitor: increase size of text on hard	✓		low	med.	med.

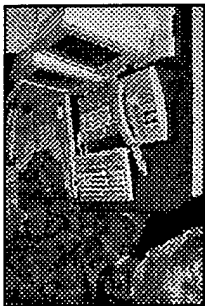
Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		copy; improve clarity of text on hard copy.					
	Un-corrected visual disorders cause the person to lean forward to read monitor or documents	6. Check eyes and correct for visual disorders and encourage person to have visual disorders corrected.		✓	med. to high	med.	med.
	Light levels too low	82. Provide task light: - increase light levels on documents being read; - light levels of between 50-100 fc are recommended for reading and writing tasks; - an adjustable task light (i.e., desk lamp) can help direct more light to the appropriate documents.		✓	low to med.	med.	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Chair too high	28. Lower chair: • set the height of the chair so that the work surface is about half way between resting elbow height and shoulder height.	✓		low	low	med.
	• Work surface too low	86. Raise desk: • set the height of the document support surface so that the work surface is about half way between resting elbow height and shoulder height.	✓	✓	low	low	med.

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	Angle and position of work surface/document used for writing (see Figure 2.6)  Figure 2.6	4. Angle work surface to bring work closer to the body and the eye: - if document is handled, flipped or written on, an inclined work surface is preferred; - the inclined surface should be able to be moved easily and, preferably, adjustable in incline; - the inclined surface needs a stop at the bottom to hold papers; - the inclined surface can be a purchased accessory or it can be made by taping several empty 3-ring binders together and taping a clip board or a piece of card board at the bottom to hold the papers.	✓		low	low	med.
9. Repeated wrist movements		34. Move items closer to body: - prioritize the location of items on the workstation according to frequency of use; - those items which are more frequently used should be closer to the body and more easily accessible.	✓		low	low	med.

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		44. Orient paper by turning it so that the area worked on is close to the body and a straight wrist is maintained while writing.	✓		low	low	low
	Person rests wrists on front edge of large book or binder that is used for writing	95. Train proper body mechanics posture: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying ; - encourage person to avoid bending the wrists while resting the hands.	✓		low	low	low
		18. Install palm rest: - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; - a palm rest is only necessary if there is not another comfortable place to rest the hands without having to bend the wrists.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
10. Repeated finger movements	• Writing speed and length of task • Length of task without a work break	95. Train proper body mechanics posture and encourage the person to avoid rushing. 13. Incorporate health comfort strategies: – alternate tasks; – stretch; – take rest pauses.	✓		low	med.	med.
		88. Redesign job: • adjust job activities to distribute keying activities throughout the day; • break up continuous keying and mousing tasks with other types of tasks.		✓	low to med.	med.	med.
11. Hyper-extension of finger/thumb	• Rarely occurs	N/A					
12. Hand forces	• Gripping the pen/pencil too hard	96. Train proper body mechanics; encourage person to practice using as light a grip as possible on the pen or pencil.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		2. Alternate grips for pen to help reduce gripping force: attach a compressible grip surface to pens/pencils to reduce forces required to hold pen/pencil	✓		low	low	low
13. Hard edges	Wrists rest on edge of work surface or 3-ring binder (see Figure 2.7) 	18. Install palm rest: - the hard edge can be eliminated by attaching a rounded edge to the front edge of the work surface. This option is generally preferred over the use of a palm rest; - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; - a palm rest is only necessary if there is not another comfortable place to rest the hands without having to bend the wrists.	✓	✓	low to med.	low	low

Case Study 2 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Hard arm rests	94. Train worker to properly adjust chair: attach padding to the armrests to eliminate exposure to hard edges.	✓		low	low	low

Case Study 2 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		78. Provide proper chair: • provide a chair with padded armrests.		✓	med to high	low	low
14. Repeated forearm rotation	• Rarely occurs	N/A					

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	Document positioned flat on work surface	4. Angle work surface to bring work closer to the body and the eye: - if document is handled, flipped or written on, an inclined work surface is preferred; - the inclined surface should be able to be moved easily and, preferably, adjustable in incline; - the inclined surface needs a stop at the bottom to hold papers; - the inclined surface can be a purchased accessory or it can be made by taping several empty 3-ring binders together and taping a clip board or a piece of card board at the bottom to hold the papers.	✓		med	med	med
	Documents too far away or too far to the side	35. Move item closer to body: - position documents so they can be read easily without leaning forward; - prioritize the location of items on the workstation according to frequency of use.	✓		low	med	med

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Text is difficult to read	12. Improve character size and style on document and monitor: - increase size of text on hard copy; - improve clarity of text on hard copy.	✓		low	med	med
	Uncorrected visual disorders cause the person to lean forward to read monitor or documents	6. Check eyes and correct for visual disorder: encourage person to have visual disorders corrected.		✓	med to high	med	med
	Light levels too low	82. Provide task light: - increase light levels on documents being read; - light levels of between 50-100 fc are recommended for reading and writing tasks; - an adjustable task light (i.e., desk lamp) can help direct more light to the appropriate documents.		✓	low to med	med	med

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Chair too high	28. Lower chair: set the height of the chair so that the work surface is about half way between resting elbow height and shoulder height.	✓		low	low	med
	Work surface too low	86. Raise desk: set the height of the document support surface so that the work surface is about half way between resting elbow height and shoulder height.	✓	✓	low	low	med
	Person has a habit of leaning forward while working.	95. Train worker on proper body mechanics: - encourage person to rest the back against back rest and sit back and relax while working; - encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	med	med

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inappropriate chair adjustment	94. Train worker to properly adjust chair: - adjust back rest to support lower back; - attach a small pillow to back rest to support lower back.	✓		low	med	med
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med to high	med	med
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	med	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	med	med

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Seat pan on chair is too deep	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low	med	med
	• Inadequate foot support causes person to not lean against back rest. • Chair too high causes person not lean against back rest.	81. Provide footrest: • provide a footrest which allows both the heels and toes to be supported; • a footrest can be a purchased item ; • a box or several ring binders taped securely together can also be used; • A footrest of one height may not be appropriate for all sized individuals or workstations (footrests which come in several heights or are adjustable in height are preferred); • a footrest should be large enough to allow the feet to move freely (a size of 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		med to high	med	med
					low	low	low

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms;	✓		low	low	low
16. Repeated bending	Reaching for items too far from body (See Figure 2.8)  Figure 2.8	35. Move item closer to body: - position documents so they can be read easily without leaning forward; - prioritize the location of items on the workstation according to frequency of use.	✓		low	med	med
17. Lifting forces	Rarely occurs	N/A					
18. No foot support	Chair too high	28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low

Case Study 2 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Feet are unsupported	76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests which come in several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low to med	low	low

Case Study 2 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or worksurface presses into legs	Feet are not supported	76. Provide footrest: - a footrest can support the feet and simultaneously reduce pressure on the back of the leg; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrest footrests which come in several heights or which are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low to med	low	low

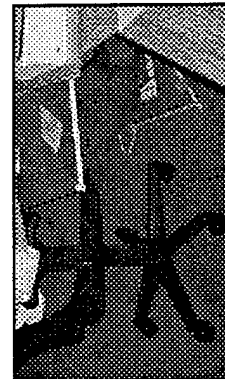


Figure 2.9

Case Study 2 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes rest comfortably on the floor or other foot rest; - insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
	Seat pan has a hard front edge	94. Train worker to properly adjust chair: provide a cushion for the seat pan to prevent contact with hard edge.	✓		low to med	low	low
		78. Provide proper chair. provide a chair with a rounded front edge on the seat pan.		✓	med to high	med	med
	Seat pan too long	75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.		✓	med	low	low
				✓	med	low	low

Case Study 2 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Obstructions under worksurface interfere with leg clearance and expose person to hard edges: - pencil drawers - keyboard trays - or structural supports	89. Remove clutter from under work surface: - eliminate obstructions; - remove pencil drawers; - replace problem keyboard trays with trays that do not expose person to hard edges.	✓	✓	low to med	med	med
20. Hard floor surfaces	Rarely occurs	N/A					
21. Kneeling/squatting	Rarely occurs	N/A					

Case Study 2 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Length of work task without a change of position for the eyes.	46. Periodically look away from screen/document. 13. Incorporate health comfort strategies: – alternate tasks – stretch – take rest pauses	✓		low	med	med
23. Glare	- Glare directly from a light source (e.g., looking towards an uncovered window) - Glare from an uncovered window reflected off surfaces - Task light shines into eyes (See Figure 2.10)	8. Close blinds or curtains: provide window coverings if not available. 9. Cover or turn out under-cabinet lighting: - cover the task light to prevent it from shining into eyes; and, - replace under-cabinet lighting with an adjustable desk lamp. 40. Move monitor out from under-cabinet lighting.	✓	✓	low	med	med

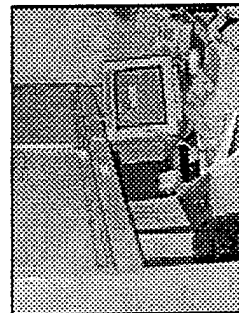


Figure 2.10

Case Study 2 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
24. Light levels	Light level too low to read document	82 Provide task light: - provide task light (50-100 fc is an appropriate range of light levels for reading tasks); - increase overall light levels to meet the lighting needs of computer and paper tasks (50 fc is an appropriate light level where both computer and paper tasks are performed).		✓	low to med	med	med
25. Screen distance	Rarely occurs	N/A					
26. Difficult to read	- Document text too small - Document text hand written hard to read	12. Improve character size and style on document and monitor: - increase size of text on hard copy; - improve clarity of text on hard copy.	✓		low	med	med

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CASE STUDY - 3 Stapling

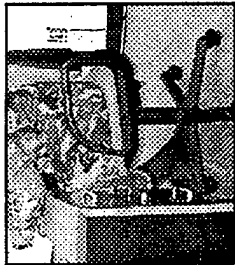
TASK TITLE: Stapling

Task Description:	Stapling may involve the use of a hand-held stapler or a desk-top stapler for stacks of paper. Stapling may involve removing staples with a staple remover, sorting paper, straightening the stack, and stapling the stack. The length of time stapling varies significantly for stapling tasks. (Note: Some of the controls suggested in this case study may also apply to hole punching.) Typical jobs in which stapling is performed include: • copying and sorting • customer service
Job Performance Measures Most often impacted by Stapling:	Error rates, number of documents processed
Typical Employee Comments about Stapling:	Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, back/torso, and shoulders/neck.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	Stapler too far from body	42. Move stapler closer to work-surface edge: when the stapler is being used with high frequency, it should be positioned close to the edge of the work surface.	✓		low	med.	med.
	- Work surface too high - Chair too low	30. Lower work surface: set the height of the work surface so that the person's elbows are at the same height as the stapler.	✓		low to med.	low	low
		85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the stapler; - in some cases, a footrest will be required in order to support the person's feet.	✓		low	low	low
	Chair positioned too far away	33. Move chair closer to work surface: encourage person to push his or her chair toward the workstation in order to reduce the tendency to reach or lean forward.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Arms of chair interfere with moving chair closer  Figure 3.1	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med.	low	med.
	Lack of leg clearance under desk	78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med.	low	low
		89. Remove clutter from under work surface.	✓		low	low	med.
2. Repeated reaching	Stapler too far from body	42. Move stapler closer to work-surface edge. while the stapler is being used with high frequency, it should be positioned close to the edge of the work surface.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Items used frequently not positioned close to the body  Figure 3.2	34. Move items closer to body: - prioritize the location of items on the workstation according to frequency of use; - frequently used items should be positioned closer to the body and easily accessible.	✓		low	med. to high	med.
3. Shrugging; working with the shoulders shrugged	- Work surface too high - Chair positioned too low	30. Lower work surface: - set the height of the work surface so that the person's elbows are at the same height as the stapler. 85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the stapler; - Note: in some cases, a footrest will be required in order to support the person's feet.	✓		low to med.	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Drawer under work surface restricts chair height	71 Provide alternative work surface: - remove drawer; - provide a workstation with no obstructions under the work surface such as pencil drawers or structural brackets.	✓		med.	low	med.
4. Repeated arm forces	Rarely occurs	N/A					
5. Holding/carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulder	Rarely occurs	N/A					
7. Head bent down, up, or neck twisted	Rarely occurs	N/A					

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	Work surface too high  Figure 3.3	30. Lower work surface: - set the height of the work surface so that the person's elbows are at the same height as the stapler. 85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the stapler; - in some cases, a footrest will be required in order to support the person's feet.	✓		low to med.	low	low
9. Repeated wrist movements	Length and repetition of task without a work break	13. Incorporate health comfort strategies: - alternate tasks; - stretch; and - take rest pauses.	✓		low	med.	med.
10. Repeated finger movements	Rarely occurs	N/A					
11. Hyper-extension of finger/thumb	Rarely occurs	N/A					

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
12. Hand forces	- Stapler requires substantial hand forces - High volume stapling	102. Provide automatic stapler: for high volume stapling tasks, provide a stapler which does not require high hand forces.	✓	✓	med. to high	med.	med.
		108. Use larger stapler with longer lever arm: a larger stapler may reduce the force required to actuate the stapler.	✓		low	med.	med.
13. Hard edges	Hard edge on front of stapler	18. Install palm rest: attach compressible padding to the top of the stapler to eliminate exposure to hard edges.	✓		low	med.	med.
		102. Provide automatic stapler: for high volume stapling tasks, provide a stapler which does not require exposure to hard edges.		✓	med. to high	med.	med.

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
14. Repeated forearm rotation	• Turning pages • Manipulating documents	13. Incorporate health comfort strategies: • alternate tasks; • stretch; • take rest pauses.	✓		low	med.	med.
		34. Move items closer to body: • prioritize position of items on the workstation according to frequency of use; • those items used frequently should be closer to the body and easily accessible.	✓		low	med. to high	med.
		88. Redesign job: • computerize some portion of the documents to reduce excessive document handling.		✓	low to med.	med.	med.

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	Documents too far away or too far to the side	35. Move item closer to body: - position documents so they can be read easily without leaning forward; - prioritize the location of items on the workstation according to frequency of use.	✓		low	low	med.
	Light levels too low	82. Provide task light: - increase light levels on documents being handled; - light levels of between 50-100 fc are recommended for paper tasks; - an adjustable task light (i.e., desk lamp) can help direct more light to the appropriate documents.	✓		low to med.	med.	med.
	Chair too high	28. Lower chair: set the height of the chair so that the work surface is about half way between resting elbow height and shoulder height.	✓		low	low	low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Work surface too low	86. Raise desk: set the height of the document support surface so that the work surface is about half way between resting elbow height and shoulder height.	✓		low	low	low
	Person has the unconscious habit of leaning forward while working	95. Train proper body mechanics: - encourage person to rest the back against back rest and sit back and relax while working; - encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	low	med.
	Inappropriate chair adjustment	94. Train worker to properly adjust chair: - adjust back rest to support lower back; - pull chair forward and lean back while working; - attach a small pillow to back rest to support lower back.	✓		low	low	low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med.	low	low
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med.	low	med.
	Seat pan on chair is too deep	78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med.	low	low
		75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med.	med.	med.
				✓	med to high	med	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Inadequate foot support causes person to not lean against back rest - Chair too high causes person not lean against back rest	76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item; - a box or several ring binders taped securely together can also be used; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred); and - a footrest should be large enough to allow the feet to move freely (size of 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low to med.	low	low
		28. Lower chair: adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest;	✓		low	low	low

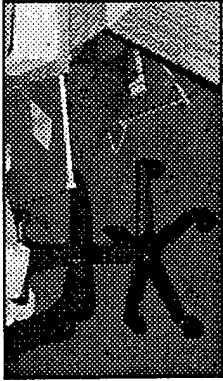
Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		care must be given to ensure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.					
16. Repeated bending	- Reaching and bending to use the stapler - Reaching for items too far from body	42. Move stapler closer to work-surface edge: - while the stapler is being used with high frequency, it should be positioned close to the edge of the work surface. 35. Move item closer to body: - position documents so they can be read easily without leaning forward; - prioritize the location of items on the workstation according to frequency of use.	✓		low	low	low
17. Lifting forces	Rarely occurs	N/A					

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
18. No foot support	Chair too high	28. Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
	Feet are unsupported	76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within come in several heights or are adjustable in height are preferred); and - a footrest should be large enough to allow the feet to move freely (size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low to med.	low	low

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	Feet are not supported	76. Provide footrest: a footrest can support the feet and simultaneously reduce pressure on the back of the leg.  Figure 3.4	✓		low to med.	low	low
		28. Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Seat pan has a hard front edge	94. Train worker to properly adjust chair: • provide a cushion for the seat pan to prevent contact with hard edge.	✓		low	low	low
		78. Provide proper chair: • provide a chair with a rounded front edge on the seat pan.		✓	med.	low	low
	• Seat pan too long	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med.	med.	med.
	• Obstructions under work surface interfere with leg clearance and expose person to hard edges: – pencil drawers; – keyboard trays; – or structural supports.	89. Remove clutter from under work surface: • eliminate obstructions; • remove pencil drawers; • replace problem keyboard trays with trays that do not expose person to hard edges.	✓		low	low	med.

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
20. Hard floor surfaces	Rarely occurs	N/A					
21. Kneeling/squatting	Rarely occurs	N/A					
22. Staring at screen or document	Rarely occurs	N/A					
23. Glare	Rarely occurs	N/A					
24. Light levels	Rarely occurs	N/A					
25. Screen distance	Rarely occurs	N/A					
26. Difficult to read	Rarely occurs	N/A					

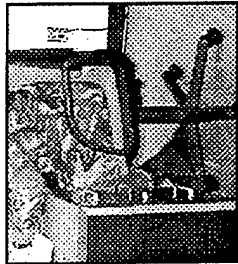
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CASE STUDY - 4 Monitoring Visual Display (Vigilance)

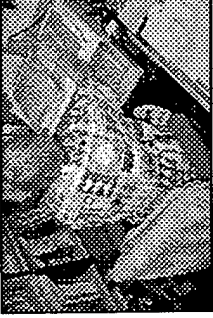
TASK TITLE: Monitoring

Task Description:	Monitoring involves the use of a monitor or series of monitors, keyboard (conventional), mouse (conventional) and a telephone. The length of time spent monitoring varies significantly for monitoring tasks as well as the type of work which is typically performed. Information used for the task typically comes from the monitor. Periodically required information will come from systems manuals. Typical jobs in which monitoring is performed include: • weather station • radar control
Job Performance Measures Most often impacted by Monitoring:	Error rates
Typical Employee Comments about Monitoring:	Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, shoulders/neck, and head/eyes.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	Keyboard too high.  Figure 4.1	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; - a footrest may be required to support the person's feet.	✓		low	low	low
		30. Lower keyboard tray or work surface: set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓		low to med.	low	med.
	- Chair positioned too far away - Arms of chair prohibit moving chair closer to desk  Figure 4.2	33. Move chair closer to work surface.	✓		low	low	low
		90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med.	low	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Lack of a place to rest the hands  Figure 4.3	36. Move keyboard forward so forearms rest evenly on surface; if work surface is deep enough, this is simply a matter of pushing the keyboard back on the work surface; if the work surface depth is restricted, providing this space would require using a different work surface for computer work.	✓		low	low	low
	Lack of leg clearance under desk	89. Remove clutter from under work surface.	✓		low	low	med.
	Mouse positioned too high  Figure 4.4	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the mouse; - a footrest may be required to support the person's feet.	✓		low	low	low
		30. Lower keyboard tray or work surface: set the height of the mouse support surface so that the person's elbows are at the same height as the mouse.	✓	✓	low to med.	low	med.

Case Study 4 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Mouse not positioned next to keyboard  Figure 4.5	63. Position mouse next to keyboard: - provide a work surface that allows the mouse and keyboard to be placed side by side and at the same height; - position mouse and keyboard so the forearm can be rested on the work surface while keying and mousing.	✓	✓	low to med.	low	low
	Keyboard tray used with mouse placed on desk  Figure 4.6	17. Install larger keyboard tray: replace the current keyboard tray with a tray which accommodates a mouse/input device and a keyboard.		✓	med.	low	med.
		49. Place keyboard and mouse on work surface: provide a work surface which is large enough to support a keyboard and mouse.		✓	med.	low	med.
	Items used frequently not positioned close to the body	35. Move item in work zone: items which are used every few minutes or more should be placed close to the body.	✓		low	low	med.

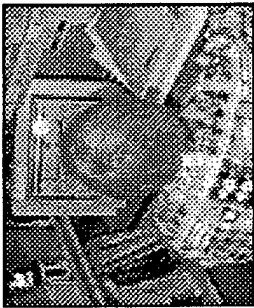
Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Repeated reaching	Reaching for items too far from body  Figure 4.7	35. Move items in work zone.	✓		low	low	med.
3. Shrugging: working with the shoulders shrugged	- Keyboard too high - Chair positioned too low - Drawer under work surface restricts chair height	30. Lower keyboard tray or work surface: - set the height of the work surface so that the person's elbows are at the same height as the keyboard. 85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; - Note: in some cases, a footrest will be required in order to support the person's feet. 71 Provide alternative work surface: - remove drawer; provide a workstation without obstructions under the work surface (e.g., pencil drawers or structural brackets).	✓	✓	low to med.	low	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person has tendency to tense the shoulders while working	23. Incorporate health comfort strategies: - encourage the person to relax while working – breath frequently – alternate tasks – stretch – take rest pauses	✓		low	low	med.
		95. Train proper body mechanics/posture: encourage the person to let the shoulders down and relax while keying.	✓		low	low	med.
4. Repeated arm forces	Rarely occurs	N/A					
5. Holding/carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulder	Talking on the telephone (using a hand set) while both hands are occupied (e.g., keying or doing paper work)	83. Provide telephone headset: provide a selection of head set types to choose from (e.g., over-the-head, over-the-ear).		✓	med.	med.	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		101. Use an available telephone headset.	✓		low	med.	med.
	• Monitor positioned too low  Figure 4.8	59. Position monitor just below eye level: • raise the monitor; • monitor should be positioned such that the top of the screen is between 0-4" (0-10.16 cm) below eye height; • use a monitor riser, CPU/hard drive, or other stable surface to position monitor at the correct height.	✓		low	low	med.
	• Monitor positioned too high  Figure 4.9	59. Position monitor just below eye level: • lower the monitor; • monitor should be positioned such that the top of the screen is between 0-4" (0-10.16 cm) below eye height; • use a monitor riser, CPU/hard drive, or other stable surface to position monitor at the correct height.	✓		low	low	low
				✓		low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
7. Head Bent down, up, or neck twisted	Monitor and keyboard not aligned  Figure 4.10	61. Position monitor in front of body: position monitor so that it is directly behind the keyboard (this allows the body to be in alignment and prevents twisting of the neck);	✓		low	med.	med.
		- provide a work surface that is deep enough to support the keyboard and the monitor screen. For large monitors, this indicates a work surface which is at least 30" (76.2 cm) deep; - provide a work surface that is large enough for computer and paper tasks; - use of keyboard trays and monitor support arms can be used in some situations, however, they often have unwanted side effects.		✓	med. to high	med.	med.
	Monitor greater than 30" inches from eye causes the person to lean forward to read monitor	34. Move items closer to body: - position monitor between 18 and 30" (45.72cm - 76.2cm) from eyes; 22"-24" (55.88cm - 60.96cm) is a good distance for many people.	✓		low	med. to high	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Un-corrected visual disorders cause the person to lean forward to read monitor or documents - Individual wears bifocals	6. Check eyes and correct for visual disorders: - encourage person to have visual disorders corrected. 6. Check eyes and correct for visual disorders: - provide monofocal or tri-focal computer glasses.	✓		med. to high	med. to high	high
		59. Position monitor directly on the work surface: for bifocal users, place monitor directly on the work surface or a bit higher so that the head is upright not tilted back (ensure that this does not cause glare problems. If it does, computer glasses may be a better solution).		✓	low	med	med
	Multiple monitors used.	61. Position monitor in front of body: - prioritize the location of monitors based on importance and frequency of use; - place most important and most frequently used monitors in front of the body.	✓		low	med.	med.

Case Study 4 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		59. Position monitor directly on the work surface: • prioritize the location of monitors based on importance and frequency of use; • place most important and most frequently used monitors so the top of the screen is between 0-4" below eye height.		✓	low	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	• Keyboard/typewriter too high • Work surface too high • Keyboard is above elbow height	30. Lower work surface/keyboard tray: • if the work surface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; this is the preferred strategy because it doesn't require a foot rest.	✓	✓	low to high	low	med.
		85. Raise chair: • set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; • This strategy is best when the work surface is not easily adjustable in height; • a footrest may be required to support the person's feet.	✓		low	low	low

Case Study 4 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Keyboard/typewriter too low • Keyboard is below elbow height when chair height is adjusted so that the person's feet are flat on the floor	87. Raise keyboard or work surface: • if the work surface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; • if the work surface is not adjustable in height, try raising the entire workstation with risers. This works best for free standing furniture but often does not work for modular furniture; • this is the preferred strategy because it doesn't require a foot rest.	✓	✓	low	low	med.
	• Keyboard is sloped towards the person	49. Place keyboard and mouse on work surface: • lower the feet on the back of the keyboard; • adjust the keyboard support surface so the keyboard is flat and level.	✓		low	low	med.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person rests wrists on front edge of the keyboard or the work surface immediately in front of the keyboard	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying ; - encourage person to avoid bending the wrists while resting the hands.	✓		low	med.	med.
		18. Install palm rest: a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;	✓		low	med.	med.

Case Study 4 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person constantly rests wrists on the wrist rest while keying	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying; - encourage person to use arm movement to move around on the keyboard rather than a wrist movement; - encourage person to avoid bending the wrists while resting the hands; - rest hands in lap or on arm rests while pausing.	✓		low	med.	med.
		18. Install palm rest: - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; - generally, a palm rest which is approximately the same height as the keys will achieve this.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Leaning forward while keying or using the mouse	95. Train proper body mechanics: - encourage person to rest the back against the back rest while keying or using the mouse; - this reduces the tendency to bend the wrists back while keying or using the mouse.	✓		low	med.	med.
	Position of mouse in relation to keyboard	107. Use keyboard tray that accommodates mouse, keyboard, and palm support.		✓	low to med.	med.	med.
	Mouse is too far away from body	63. Position mouse next to keyboard: - position the mouse directly adjacent to the keyboard and at approximately the same height as the keyboard; - position mouse and keyboard so the forearm can be rested on the work surface while keying and mousing.	✓		low	low	low
	 Figure 4.11 Using wrist movement to move mouse rather than arm movement	95. Train proper body mechanics posture: encourage person to use a forearm movement to move the mouse rather than a wrist movement.	✓		low	low	low

Case Study 4 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. Repeated wrist movements	Rarely occurs	N/A					
10. Repeated finger movements	- Keying/typing speed and length of task - Length of task without a work break	67. Program macro keys to reduce keying: - macros are small programs that can be useful for highly repetitive keying or mousing actions. 95. Train proper body mechanics posture: - encourage the person to avoid rushing. 13. Incorporate health comfort strategies: - encourage the person to relax while working – breath frequently – alternate tasks – stretch – take rest pause 88. Redesign job: - adjust job activities to distribute keying activities throughout the day; - break up continuous keying and mousing tasks with other types of tasks.	✓		low	high	high
			✓		low	low	low
			✓		low	med.	med.
			✓	✓	low to med.	med.	med.
			✓		low	med	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
11. Hyper-extension of finger/thumb	- Small input device (e.g., track ball, glide point) requires single finger activation - Person has tendency to hyperextend fingers or thumbs while keying	15. Install alternative mouse: - provide a full-size input device such as a mouse or large track-ball. 98. Train proper mousing style: - encourage person to avoid extending fingers while mousing or keying; - encourage person to keep all of the fingers curled under and together.	✓	✓	low to high	low	med.
			✓		low	low	low
12. Hand forces	Person tends to hit keys hard	96. Train proper keying style: encourage person to practice using as light a touch as possible on keys and buttons.	✓		low	low	low
	Person tends to place a heavy grip on mouse or click mouse buttons hard	98. Train proper mousing style: encourage person to practice keeping a light grip on the mouse.	✓		low	low	low
	Keys are stiff	22. Investigate use of alternative keyboard: - provide a keyboard with keys which do not require excessive forces to actuate; - keys should provide adequate auditory and tactile feedback when actuated.		✓	med. to high	med.	med.

Case Study 4 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact drop On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Mouse buttons are stiff	15. Install alternative mouse: • provide a mouse with buttons which do not require excessive forces to actuate.	✓	✓	med. to high	med.	med.
	• Lack of appropriate tactile feedback ("click")	22. Investigate use of alternative keyboard: • keys should provide adequate auditory and tactile feedback when actuated.		✓	low to high	med.	med.
		15. Install alternative mouse: • mouse buttons should provide adequate auditory and tactile feedback when actuated.		✓	med to high	med	med

Case Study 4 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	Wrists rest on edge of work surface (See Figures 4.12 and 4.13) Figure 4.12  Figure 4.13 	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; - a footrest may be required to support the person's feet. 30. Lower keyboard tray or work surface: - set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓		low	low	low
		36. Move keyboard forward so forearms rest evenly on surface: - this reduces the tendency to rest the wrists/forearms on the hard edge; - if the work surface depth is restricted, providing this space would require using a different work surface for computer work.	✓		low to med	low	med
				✓		low	low
						low	low

Case Study 4 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		18. Install palm rest: • the hard edge can be eliminated by attaching a rounded edge to the front edge of the work surface. This option is generally preferred over the use of a palm rest; • a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; • a palm rest is not recommended for a mouse because it results in awkward wrist movements.	✓		low	med	med
	• Work surface is not deep enough to provide a place to rest the hands in front of the keyboard • Hard arm rests	107. Use keyboard tray that accommodates mouse, keyboard, and palm support. 77. Provide larger work surface. 94. Train worker to properly adjust chair: • attach padding to the armrests to eliminate exposure to hard edges.		✓	high	med	med
			✓		low	low	low

Case Study 4 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		78. Provide proper chair • provide a chair with padded armrests.		✓	med	low	low
14. Repeated forearm rotation	• Rarely occurs	N/A					

Case Study 4 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	• Monitor too far from eyes	58. Position monitor 18" - 30" (45.72-76.2 cm) from the eyes: • 22"-24" (55.88cm - 60.96 cm) is a good distance for many people.	✓		low	med	med
	• Text is difficult to read	12. Improve character sizes and style on document and monitor: • increase font size of text; • font size of at least 12 point are recommended for screen distances of 18"-30" (45.72-76.2 cm); • font sizes of greater than 12 point is recommended for screen distances of greater than 30" (76.2 cm).	✓		low	med	med
	• Person has a habit of leaning forward while working	95. Train proper body mechanics: • encourage person to rest the back against back rest and sit back and relax while working; • encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	med	med

Case Study 4 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inappropriate chair adjustment	94. Train worker to properly adjust: - adjust back rest to support lower back; - pull chair forward and lean back while working; - attach a small pillow to back rest to support lower back.	✓		low	med	med
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med to high	med	med
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	med	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	med	med

Case Study 4 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Seat pan on chair is too deep	75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med	med	med
	- Inadequate foot support causes person to not lean against back rest - Chair is too high and causes person not lean against back rest	81. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item) ; - a box or several ring binders taped securely together can also be used; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		med to high	med	med
					low to med	low	low

Case Study 4 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28. Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to ensure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
	Multiple monitors used	61. Position monitor in front of body: - prioritize the location of monitors based on importance and frequency of use; - place most important and most frequently used monitors in front of the body.	✓		low	med	med
		59. Position monitor directly on the work surface: - prioritize the location of monitors based on importance and frequency of use; - place most important and most frequently used monitors so the top of the screen is between 0-4" (0-10.16 cm) below eye height.	✓		low	med	med

Case Study 4 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Repeated bending	Reaching for items too far from body  Figure 4.14	35. Move items in work zone.	✓		low	med	med
17. Lifting forces	Rarely occurs	N/A					
18. No foot support	- Chair too high - Feet are unsupported.	28. Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - ensure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms. 76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized	✓		low	low	low

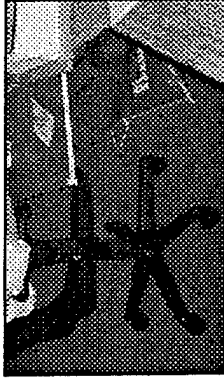
Case Study 4 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		individuals or workstations (footrests within several heights are adjustable in height are preferred); a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).					

Case Study 4 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	Feet are not supported	76. Provide footrest: - a footrest can support the feet and simultaneously reduce pressure on the back of the leg; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low to med	low	low
		 Figure 4.15					

Case Study 4 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - ensure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
	Seat pan has a hard front edge	94. Train worker to properly adjust chair: provide a cushion for the seat pan to prevent contact with hard edge.	✓		med	low	low
		78. Provide proper chair: provide a chair with a rounded front edge on the seat pan.		✓	med to high	low	low
	Seat pan too long	75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		med	low	low
				✓	med to high	med	med

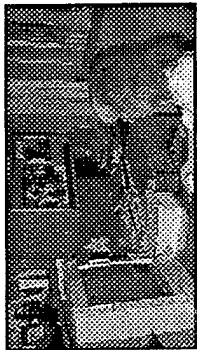
Case Study 4 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Obstructions under work surface interfere with leg clearance and expose person to hard edges: - pencil drawers; - keyboard trays; - or structural supports.	89. Remove clutter from under work surface: - eliminate obstructions; - remove pencil drawers; - replace problem keyboard trays with trays that do not expose person to hard edges.		✓	low to high	med	med
20. Hard floor surfaces	Rarely occurs	N/A					
21. Kneeling/squatting	Rarely occurs	N/A					

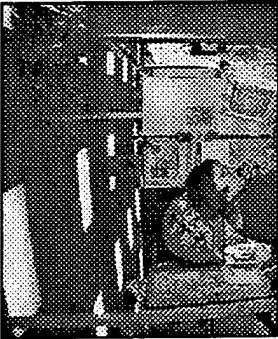
Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity	
22. Staring at screen or document	Length of work task without a change of position for the eyes	46. Periodically look away from screen. 13. Incorporate health comfort strategies: - encourage the person to relax while working – breath frequently – alternate tasks – stretch – take rest pause	✓		low	low	low	
23. Glare	- Glare directly from a light source (e.g., looking towards an uncovered window) - Glare from an uncovered window reflected off monitor or other shiny surfaces  Figure 4.16	53. Place the monitor perpendicular to the window. 8. Close blinds or curtains: provide window coverings if not available.	✓		low to med	med	low	

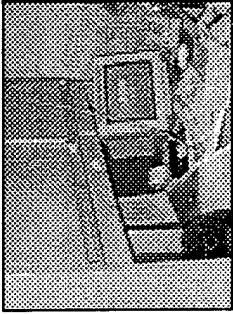
Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Glare directly from a light source: looking towards an overhead light - Glare from an overhead or task light reflected off monitor or other shiny surfaces  Figure 4.17	60. Position the monitor between rows of overhead lights: - position monitor so that no overhead lights are visible directly above the monitor when looking at the screen; - place the workstation so that it faces a wall or partition.	✓	✓	low to med	med	med
		31. Lower light levels: remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area.		✓	low to med	med	med
		20. Install parabolic louvers to direct light down on the surface: provide alternative light fixtures for overhead lights (parabolic louver fixtures are recommended when computer work is the pre-dominant activity.) Note: this should be performed by the appropriate personnel.		✓	high	med	med
		79. Provide screen hood/visor. 93. Tilt monitor down so that the	✓		low	med	med

Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		screen is vertical.	✓		low	med	med
	Task light shines into eyes  Figure 4.18	9. Cover or turn out under-cabinet lighting: - cover the task light to prevent it from shining into eyes. 40. Move monitor out from under-cabinet lighting. 10. Direct task light away from screen and eyes: - if necessary, provide a more easily adjustable task light.	✓		low	low	low
			✓		low	low	low
			✓		low	med	med
			✓		low	low	low

Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
24. Light levels	- Light levels too high around monitor - Light level too low to read document	31. Lower light levels: - turn off task light; 20-50 fc is an appropriate range of light levels for computer tasks; - remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area; - provide alternative light fixtures for overhead lights (parabolic louver fixtures are recommended when computer work is the pre-dominant activity.) Note: this should also be performed by the appropriate personnel; - if light levels for the monitor are adjusted appropriately, it may still be necessary to increase light levels for paper tasks using a task light/desk lamp.	✓	✓	med to high	med	med

Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
25. Screen Distance		82. Provide task light: - provide task light (50-100 fc is an appropriate range of light levels for reading tasks); - increase overall light levels to meet the lighting needs of computer and paper tasks (50 fc is an appropriate light level where both computer and paper tasks are performed).	✓	✓	low to med	med	med
	Monitor positioned too close to eyes	58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: 22"-24" (55.88-60.96 cm) is a good distance for many people.	✓		low	med	med
	Not enough work surface space to position monitor far enough away from person.	52. Place monitor on alternative work surface.		✓	med	med	med
	Monitor positioned too far from eyes	58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: 22"-24" (55.88-60.96 cm) is a good distance for many people.	✓		low	med	med

Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Un-corrected visual disorders	6. Check eyes and correct for visual disorders: provide computer glasses for person's who need bifocals, provide monofocal or tri-focal computer glasses.		✓	med to high	med	med
26. Difficult to read	Font/character size too small to read on computer screen	12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point is recommended for screen distances of 18"-30" (45.72-76.2 cm; - font sizes of greater than 12 point are recommended for screen distances of greater than 30" (76.2 cm).	✓		low	med	med
	Document text too small	12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point are recommended for screen distances of 18"-30" (45.72-76.2 cm; - font sizes of greater than 12 point are recommended for screen distances of greater than	✓		low	med	med

Case Study 4 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		30" (76.2 cm).					
	• Document text hand written hard to read	12. Improve character size and style on document and monitor: • increase character size.		✓	low to high	med	med
	• VDT screen dirty	7. Clean screen regularly.	✓		low	med	med

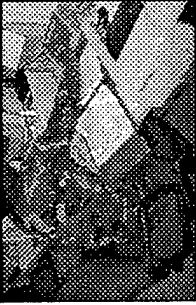
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CASE STUDY - 5 Calling (Telephone Use)

TASK TITLE: Telephone Use

Task Description:	Telephone use may involve the use of a hand set or a head set. The base of the telephone may be a push button or rotary phone. The length of time of telephone use varies significantly for calling tasks as well as the type of work that is typically performed. Information provided over the telephone may be written out by hand or entered into the computer. Typical jobs in which calling is performed include (not necessarily limited to): • customer service • general administrative support
Job Performance Measures Most often impacted by Calling:	Error rates, number of calls taken and recorded/processed.
Typical Employee Comments about Calling:	Employees typically complain about discomfort and/or stiffness in the shoulders/neck.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	- Telephone not positioned close to the body (See Figure 5.1) - Person dials frequently  Figure 5.1	43. Move telephone in work zone: - move telephone closer to body and into the primary work zone (see work zone specifications, modifications section); - move telephone so reaching is not required to dial the phone or access the hand set.	✓		low	low	low
2. Repeated reaching	- Telephone not positioned close to the body (See Figure 5.1) - Person dials frequently	43. Move telephone in work zone: - move telephone closer to body and into the primary work zone (see work zone specifications, modifications section); - move telephone so reaching is not required to dial the phone or access the hand set.	✓		low	low	low
3. Shrugging: working with the shoulders shrugged	Rarely occurs	N/A					
4. Repeated arm forces	Rarely occurs	N/A					

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
5. Holding/ carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulder	Talking on the telephone (using a handset) while both hands are occupied (e.g., keying or doing paper work)	83. Provide telephone headset: provide a selection of head set types to choose from (e.g., over-the-head, over-the-ear). 101. Use an available telephone headset		✓	med	med	med
7. Head bent down, up or neck twisted	Number display and buttons on telephone are positioned flat	3. Angle telephone base slightly: - tilt the base slightly toward the person; - avoid angling the base too much to avoid causing a bent wrist while dialing.	✓		low	low	low

Case Study 5 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	- Telephone too far away - Person tends to rest the wrist on the front edge of the phone while dialing	43. Move telephone in work zone: - move telephone closer to body and into the primary work zone (see work zone specifications, modifications section); - move telephone so reaching is not required to dial the phone or access the hand set.	✓		low	low	low
		96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying ; - encourage person to avoid bending the wrists while resting the hands; - rest hands in lap or on arm rests while pausing.	✓		low	med	med
		67. Program macro keys to reduce keying: - provide speed dial functions for commonly used functions; - employ computer-based dialing for highly repetitive dialing.	✓		low	high	high

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. Repeated wrist movements	Rarely occurs	N/A					
10. Repeated finger movements	Person makes many phone calls and dials many number throughout the day	67. Program macro keys to reduce keying: - provide speed dial functions; commonly used functions; - employ computer-based dialing for highly repetitive dialing.	✓		low	high	high
		13. Incorporate health comfort strategies: – breath frequently – alternate tasks; – stretch; – take rest pause.	✓		low	med	med
11. Hyperextension of finger/thumb	- Person has tendency to hyperextend the index finger while dialing - Use of a rotary phone	96. Train proper keying style: - encourage person to avoid extending fingers while keying; - encourage person to keep all of the fingers curled under and together.	✓		low	med	med
		21. Install a push button phone: provide a touch-tone phone.		✓	med to high	med	med
		67. Program macro keys to reduce keying:	✓		low	high	high

Case Study 5 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		- provide speed dial functions for commonly used functions; - employ computer-based dialing for highly repetitive dialing.					
12. Hand forces	Poor typing style (e.g., hit keys hard)	96. Train proper keying style: encourage person to practice using as light a touch as possible on buttons.	✓		low	med	med
	- Keys stiff - Lack of appropriate tactile feedback (e.g., a "click")	22. Install push button phone: - provide a keypad which does not require excessive forces to actuate; - keys should provide adequate auditory and tactile feedback when pressed.		✓	med to high	med	med
		67. Program macro keys to reduce keying: - provide speed dial functions for commonly used functions; - employ computer-based dialing for highly repetitive dialing.	✓		low	high	high

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	- Person tends to rest the wrist on the front edge of the phone while dialing - Front edge of phone has a hard edge	18. Install palm rest: - cover the hard edge with a small palm rest for frequent dialers. 67. Program macro keys to reduce keying: - provide speed dial functions for commonly used functions; - employ computer-based dialing for highly repetitive dialing.	✓		low	med	med
14. Repeated forearm rotation	Rarely occurs	N/A					
15. Leaning forward/no back support	Chair arms interfere with moving chair closer	90. Remove or lower armrests: - remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation. 78. Provide proper chair: - provide a chair in which the armrests can be adjusted or removed.	✓		low to med	low	med
				✓	med	low	low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Repeated bending	Reaching for items too far from body  Figure 5.2	43. Move telephone in work zone: - move telephone closer to body and into the primary work zone (see work zone specifications, modifications section); - move telephone so reaching is not required to dial the phone or access the hand set.	✓		low	low	low
17. Lifting Forces	Rarely occurs	N/A					
18. No foot support	Rarely occurs	N/A					

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	Rarely occurs	N/A					
20. Hard floor surfaces	Rarely occurs	N/A					
21. Kneeling/squatting	Rarely occurs	N/A					

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Rarely occurs	N/A					
23. Glare	Glare reflects off of plastic phone cover	3. Angle telephone base slightly: • angling the base may eliminate the exposed glare; • if this is unsuccessful, remove plastic phone cover. 31. Lower light levels: • turn off task light; • 50-100 fc is an appropriate range of light levels for using a phone; • remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area; • provide alternative light fixtures for overhead lights (parabolic louver fixtures are recommended when computer work is the pre-dominant activity.) Note: this should also be performed by the appropriate personnel.	✓		low	low	low
				✓	low to med	med	med

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
24. Light levels	Rarely occurs	N/A					
25. Screen distance	Rarely occurs	N/A					
26. Difficult to read	Rarely occurs	N/A					

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CASE STUDY - 6 Copying/Sorting

TASK TITLE: Copying/Sorting

Task Description:	Copying and sorting may involve the use of a cart, boxes of paper, photocopier and loose paper. Typical jobs in which copying and sorting is performed include (not necessarily limited to): • customer service • general administrative support • librarians
Job Performance Measures Most often impacted by Copying/Sorting:	Error rates, number of copies made.
Typical Employee Comments about Copying/Sorting:	Employees typically complain about discomfort and/or stiffness in the back/torso, legs/feet, hands/wrists, arms, and shoulders/neck.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	• Pulling copies from copier	27. Locate sorting piles near work-surface edge.	✓		low	low	med
	• Sorting paper into separate piles on work surface(piles away from work surface edge	32. Lower sorting shelves below shoulder height.	✓		low	low	med
	• Sorting shelves too high	111. Use step stool to access high-level shelves.	✓		low	low	med
	• Carrying boxes of photocopy paper	104. Use cart to move boxes of photocopy paper.	✓		low	low	med
2. Repeated reaching	• Shelves too high for sorting	32. Lower sorting shelves below shoulder height.	✓		low	low	med
		111. Use step stool to access high-level shelves.	✓		low	low	low
	• Items used frequently not positioned close to the body	35. Move items into work zone.	✓		low	low	low
		64. Position body closer to work.	✓		low	low	low
		87. Raise the work surface: • place boxes or reams of paper at knuckle height; • provide a table to minimize reaching.	✓	✓	low med	low low	med med

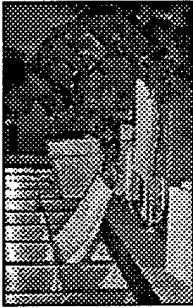
Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
3. Shrugging: working with the shoulders shrugged	Rarely occurs	N/A					
4. Repeated arm forces	- Pulling boxes of photocopy paper - Taking out stacks of photocopy paper from the photocopy boxes	95. Train proper body mechanics: - minimize reaching by positioning body as close to the load as possible; - minimize rushing and high speed movements.	✓		low	low	low
5. Holding/ carrying materials	- Carrying and holding photocopy paper box - Carrying stacks of paper	104. Use available cart to move boxes of photocopy paper. 73. Provide appropriate cart.	✓		low	low	med
6. Cradling the telephone between the neck and shoulder	Rarely occurs	N/A					
7. Head bent down, up, or neck twisted	Rarely occurs	N/A					

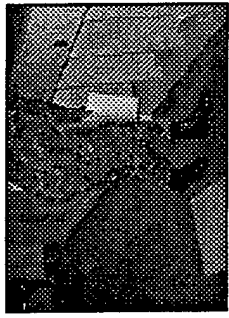
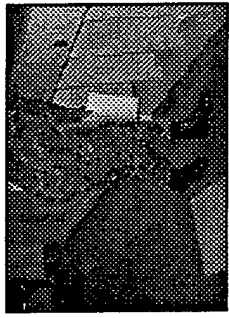
Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	Pushing book down to copy	95. Train proper body mechanics: minimize awkward wrist postures.	✓		low	low	med
9. Repeated wrist movements	- Sorting paper into stacks - Handling paper  Figure 6.1	95. Train proper body mechanics: minimize awkward wrist postures.	✓		low	low	med
		91. Rotate staff members between tasks.	✓		low	low	med
		88. Redesign job: - eliminate unnecessary document handling by combining tasks; - eliminate unnecessary activities.	✓		med	med	high
10. Repeated finger movements	Rarely occurs	N/A					
11. Hyper-extension of finger/thumb	Rarely occurs	N/A					
12. Hand forces	Pulling copies from copier (using pinch grips)	95. Train proper body mechanics: use both hands or use a full-hand grip whenever possible.	✓		low	low	low
	Pinch grips sorting paper	70. Provide adequate storage/equipment:		✓	low to med	med	med to high

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		- eliminate unnecessary items from storage in order to increase available space. - provide a copier designed to copy books		✓	low to med	med	med to high
	 Figure 6.2	88. Redesign job: - eliminate unnecessary document handling by combining tasks; - eliminate unnecessary activities.					
13. Hard edges	Rarely occurs	N/A					
14. Repeated forearm rotation	- Turning pages - Handling documents	88. Redesign job: - eliminate unnecessary document handling by combining tasks; - eliminate unnecessary activities.		✓	low to med	med	med to high
15. Leaning forward or poor lower back posture	Rarely occurs	N/A					

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Repeated bending	Shelves positioned too low  Figure 6.3	24. Kneel to access low level of photocopier.	✓		low	low	low
	 Figure 6.3	87. Raise work surface: - avoid lifting heavy items (e.g., boxes of copier paper) from floor level; - place heavy items on sturdy tables or shelves.	✓	✓	med	low	low
	Reaching for items too far from body  Figure 6.4	26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items.	✓	✓	low to med	low	low
		35. Move items into work zone.	✓		low	low	low
		54. Position body closer to work.	✓		low	low	low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Reaching for items too far from body	34. Move items closer to body: for example, reduce or eliminate obstructions that prevent person from being closer to work.	✓	✓	low to high	med	med
		95. Train proper body mechanics/posture: - encourage person to keep the load as close to the body as possible while handling loads; - move as close to the load as possible before lifting.	✓		low	low	low

Case Study 6 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
17. Lifting forces	Handling heavy items while bent and/or reaching for boxes, stacks or paper or files	26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items. 34. Move items closer to body: - for example, slide items closer to the edge of a table before lifting. 104. Use available cart to move boxes, files etc.: - handle heavy items on carts; - provide appropriate sized carts for handling items in confined spaces. 95. Train proper body mechanics: - encourage person to avoid rushing while handling items; - allow adequate time to perform the task safely.	✓	✓	low to med	low to med	med to high
			✓		low	low	med
			✓		low	low	med
			✓		low	low	low
18. No foot support	Rarely occurs	N/A					

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or worksurface presses into legs	Rarely occurs	N/A					
20. Hard floor surfaces	Standing and walking on hard surfaces	110. Use proper footwear. 72. Provide anti-fatigue mats.	✓		low	low	low
21. Kneeling/ squatting	Rarely occurs	N/A		✓	med	low	low

Case Study 6 (continued)

Head/Eyes

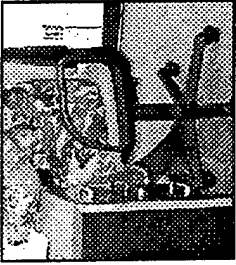
Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Rarely occurs	N/A					
23. Glare	Rarely occurs	N/A					
24. Light levels	Rarely occurs	N/A					
25. Screen distance	Rarely occurs	N/A					
26. Difficult to read	Rarely occurs	N/A					

CASE STUDY - 7 Drafting (CAD Systems):

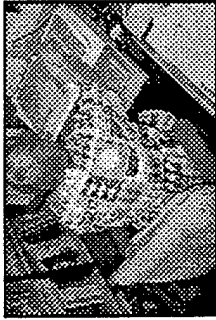
TASK TITLE: CAD Drafting

Task Description:	CAD drafting involves the use of a tablet, keyboard, and standard-shaped mouse. The mouse fits into the palm activated by either a series of two or three buttons. The tablet is used in combination with the mouse and keyboard. The length of time drafting varies significantly for drafting tasks as well as the type of work that is typically performed. Information used for drafting typically comes from a hard copy (paper size varies). Typical jobs in which CAD drafting is performed include: • engineering • drafting
Job Performance Measures Most often impacted by CAD Drafting:	Error rates; number of drawings completed.
Typical Employee Comments about CAD Drafting:	Employees often comment on their concern over the repetitive nature of the mousing task on the tablet. Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, shoulders/neck, and head/eyes.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	Tablet positioned too high  Figure 7.1	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; - a footrest may be required to support the person's feet.	✓		low	low	low
		30. Lower keyboard tray or work surface: set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓		low to med	low	med
	- Chair positioned too far away - Arms of chair interfere with moving chair closer  Figure 7.2	33. Move chair closer to work surface.	✓		low	low	low
		90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	low	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	med	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Lack of a place to rest the hands  Figure 7.3	36. Move keyboard forward so forearms rest evenly on surface; if workspace is deep enough, this is simply a matter of pushing the keyboard back on the workspace; if the workspace depth is restricted, providing this space would require using a different workspace for computer work.	✓		low	low	low
	Lack of leg clearance under desk	89. Remove clutter from under work surface.	✓		low	low	med
	Mouse positioned too high  Figure 7.4	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the mouse; - a footrest may be required to support the person's feet.	✓		low	low	low
		30. Lower keyboard tray or work surface: set the height of the mouse support surface so that the person's elbows are at the same height as the mouse.	✓	✓	low to med	low	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Mouse not positioned next to keyboard  Figure 7.5	63. Position mouse next to keyboard: - provide a worksurface that allows the mouse and keyboard to be placed side by side and at the same height; - position mouse and keyboard so the forearm can be rested on the worksurface while keying and mousing.	✓	✓	low to med	low	low
	Keyboard tray used with tablet placed on desk.  Figure 7.6	17. Install larger keyboard tray: replace the current keyboard tray with a tray which accommodates a mouse/input device and a keyboard.		✓	med	low	med
		49. Place keyboard and mouse on work surface: provide a work surface which is large enough to support a keyboard and mouse.		✓	med	low	med
	Items used frequently not positioned close to the body	35. Move item in work zone: frequently used items should be placed close to the body.	✓		low	low	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Multiple input devices used (e.g. keyboard, mouse, digital tablet) - Input devices too far away from body	34. Move items closer to body: - prioritize the location of input devices based on frequency of use. - position the most frequently used input device so that the person does not have to reach or bend the wrist while using it.	✓		low	med	med
2. Repeated reaching	- Reaching for items too far from body  Figure 7.7 - Multiple input devices used (e.g., keyboard, mouse, digital tablet) - Input devices too far away from body	35. Move items in work zone. 34. Move items closer to body: - prioritize the location of input devices based on frequency of use; - position the most frequently used input device so that the person does not have to reach or bend the wrist while using it.	✓		low	low	med
3. Shrugging: working with the shoulders shrugged	Keyboard too high	30. Lower keyboard tray or work surface: set the height of the work surface so that the person's elbows are at the same height as	✓	✓	low to med	low	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		the keyboard.					
•	Chair positioned too low	85. Raise chair: • set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; • a footrest may be required to support the person's feet.	✓		low	low	low
•	Drawer under work surface restricts chair height	71 Provide alternative work surface: • remove drawer; • provide a workstation with no obstructions under the work surface such as pencil drawers or structural brackets.	✓		med	low	med
•	Person has tendency to tense the shoulders while working	23. Incorporate health comfort strategies: • encourage the person to relax while working – breath frequently – alternate tasks – stretch – take rest pauses 95. Train proper body mechanics/posture: – encourage the person to let the shoulders drop down and relax while keying.	✓	✓	low	low	med
			✓		low	low	med

Shoulder/Neck

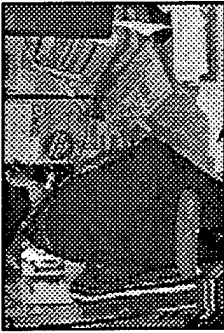
Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
4. Repeated arm forces	Rarely occurs	N/A					
5. Holding/ carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulder	- Talking on the telephone (using a handset) while both hands are occupied (e.g., keying or doing paper work) - Monitor positioned too low. 	83. Provide telephone headset: - provide a selection of head set types to choose from (e.g., over-the-head, over-the-ear). 101. Use an available telephone headset. 59. Position monitor just below eye level: - raise the monitor; - monitor should be positioned such that the top of the screen is between 0-4" (0-10.16cm) below eye height; - use a monitor riser, CPU/hard drive, or other stable surface to position monitor at the correct height.	✓	✓	med	med	med

Figure 7.8

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
7. Head Bent down, up, or neck twisted	Monitor and keyboard not aligned  Figure 7.10	61. Position monitor in front of body: - position monitor so that it is directly behind the keyboard; - this allows the body to be in alignment and prevents twisting of the neck; - provide a worksurface that is deep enough to support the keyboard and the monitor screen. For large monitors, this indicates a worksurface which is at least 30" (76.2 cm) deep; - provide a worksurface that is large enough for computer and paper tasks; - use of keyboard trays and monitor support arms may be used in some situations, however, they often have unwanted side effects.	✓		low	med	med
	Monitor greater than 30" inches from eye causes the person to lean forward to read monitor	34. Move items closer to body: - position monitor between 18" and 30" (45.72-76.2 cm) from eyes; 22"-24" (55.88-60.96 cm) is a good distance for many people.	✓	✓	med to high	med to high	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Uncorrected visual disorders cause the person to lean forward to read monitor or documents	6. Check eyes and correct for visual disorders: encourage person to have visual disorders corrected.	✓		med to high	med to high	high
	Individual wears bifocals	6. Check eyes and correct for visual disorders: provide monofocal or tri-focal computer glasses.		✓	med to high	med	med
		59. Position monitor directly on the work surface: for bifocal users, place monitor directly on the work surface or a bit higher so that the head is upright not tilted ensure that this does not cause glare problems. If it does, computer glasses are a better solution).	✓		low	low	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Working with large documents (e.g., large drawings and CAD print-outs).	4. Angle work surface to bring work closer to the body and the eye: - provide workspaces to support large documents; - drawings that are frequently moved or written on should be placed on an angled work surface (like a drawing board); - drawings that are used for reference can be hung vertically; - the goal is to position the document in a more upright position and close to the monitor screen if it is used in conjunction with computer tasks.	✓		low	med	med
				✓	med	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	• Keyboard/typewriter too high • Worksurface too high • Keyboard is above elbow height	30. Lower work surface/keyboard tray: • if the worksurface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; • this is the preferred strategy because it doesn't require a foot rest.	✓	✓	low to high	low	med
		85. Raise chair: • set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; • This strategy is best when the worksurface is not easily adjustable in height; • a footrest may be required to support the person's feet.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Multiple input devices used (e.g. keyboard, mouse, digital tablet) - Input devices too far away from body - Keyboard/typewriter too low - Keyboard is below elbow height when chair height is adjusted so that the person's feet are flat on the floor	34. Move items closer to body: - prioritize the location of input devices based on frequency of use. - position the most frequently used input device so that the person does not have to reach or bend the wrist while using it. 87. Raise keyboard or work surface: - if the worksurface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; if the worksurface is not adjustable in height, try raising the entire workstation with risers. This works best for free standing furniture but often does not work for modular furniture; this is the preferred strategy because it doesn't require a foot rest.	✓	✓	low	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Keyboard is sloped towards the person	49. Place keyboard and mouse on worksurface: - lower the feet on the back of the keyboard; - adjust the keyboard support surface so the keyboard is flat and level.	✓		low	low	med
	Person rests wrists on front edge of the keyboard or the work surface immediately in front of the keyboard	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying ; - encourage person to avoid bending the wrists while resting the hands when not keying.	✓		low	med	med
		18. Install palm rest: a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;	✓		low	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Leaning forward while keying or using the mouse	95. Train proper body mechanics: encourage person to rest the back against the back rest while keying or using the mouse; this reduces the tendency to bend the wrists back while keying or using the mouse.	✓		low	med	med
	Position of mouse in relation to keyboard	107. Use keyboard tray that accommodates mouse, keyboard, and palm support.		✓	low to med	med	med
	Mouse is too far away from body	63. Position mouse next to keyboard: - position the mouse directly adjacent to the keyboard and at approximately the same height as the keyboard; - position mouse and keyboard so the forearm can be rested on the work surface while keying and mousing.	✓		low	low	low
	 Figure 7.11 Using wrist movement to move mouse rather than arm movement	95. Train proper body mechanics posture: encourage person to use a forearm movement to move the mouse rather than a wrist movement.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. Repeated wrist movements	Rarely occurs	N/A					
10. Repeated finger movements	- Mousing speed and length of task - Length of task without a work break	67. Program macro keys to reduce keying: - macros are small programs that can be useful for highly repetitive keying or mousing actions. 95. Train proper body mechanics posture: - Encourage the person to avoid rushing. 13. Incorporate health comfort strategies: - breath frequently - alternate tasks; - stretch; - take rest pauses.	✓		low	high	high
			✓		low	low	low
			✓		low	med	med
11. Hyper-extension of finger/thumb	Small input device (e.g., track ball, glide point) requires single finger activation.	15. Install alternative mouse provide a full-size input device such as a mouse or large track-ball.		✓	low to high	low	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Person has tendency to hyperextend fingers or thumbs while keying	98. Train proper mousing style: - encourage person to avoid extending fingers while mousing or keying; - encourage person to keep all of the fingers curled under and together.	✓		low	low	low
12. Hand forces	Person tends to hit keys hard	96. Train proper keying style: encourage person to practice using as light a touch as possible on keys and buttons.	✓		low	low	low
	Person tends to place a heavy grip on mouse or click mouse buttons hard	98. Train proper mousing style: encourage person to practice keeping a light grip on the mouse.	✓		low	low	low
	Keys are stiff	22. Investigate use of alternative keyboard: provide a keyboard with keys which do not require excessive forces to actuate; keys should provide adequate auditory and tactile feedback when actuated.		✓	med to high	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Mouse buttons are stiff	15. Install alternative mouse: provide a mouse with buttons which do not require excessive forces to actuate.	✓	✓	med to high	med	med
	Lack of appropriate tactile feedback (e.g., a "click")	22. Investigate use of alternative keyboard: keys should provide adequate auditory and tactile feedback when actuated.		✓	low to high	med	med
		15. Install alternative mouse: mouse buttons should provide adequate auditory and tactile feedback when actuated.		✓	med to high	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	Wrists rest on edge of work surface (See Figures 7.12 and 7.13) Figure 7.12  Figure 7.13 	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; - Note: in some cases, a footrest will be required in order to support the person's feet.	✓	✓	low	low	low
		30. Lower keyboard tray or work surface: set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.	✓		low to med	low	med
		36. Move keyboard forward so forearms rest evenly on surface: - this reduces the tendency to rest the wrists/forearms on the hard edge; - if the work surface depth is restricted, providing this space would require using a different work surface for computer work.	✓	✓	low med	low low	low low

Case Study 7 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		18. Install palm rest: - the hard edge can be eliminated by attaching a rounded edge to the front edge of the work surface. This option is generally preferred over the use of a palmrest; - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture; - a palm rest is only necessary if there is not another comfortable place to rest the hands without having to bend the wrists; - a palm rest is not recommended for a mouse because it results in awkward wrist movements.	✓		low	med	med
	Work surface is not deep enough to provide a place to rest the hands in front of the keyboard	107. Utilize keyboard tray that accommodates mouse, keyboard, and palm support.		✓	high	med	med
	Hard arm rests	77. Provide larger work surface.		✓	med	med	med
		94. Train worker to properly adjust chair: attach padding to the armrests to eliminate exposure to hard edges.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		78. Provide proper chair • provide a chair with padded armrests		✓	med	low	low
14. Repeated forearm motion	Rarely occurs	N/A					

Case Study 7 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	• Monitor too far from eyes	58. Position monitor 18" - 30" (45.72-76.2 cm) from the eyes; • 22"-24" (55.88-60.96 cm) is a good distance for many people.	✓		low	med	med
	• Text is difficult to read	12. Improve character size and style on document and monitor: • increase font size of text; • font size of at least 12 point is recommended for screen distances of 18"-30" (45.72-76.2 cm); • font sizes of greater than 12 point are recommended for screen distances of greater than 30" (76.2 cm).	✓		low	med	med
	• Person has the unconscious habit of leaning forward while working	95. Train proper body mechanics: • encourage person to rest the back against back rest and sit back and relax while working; • encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	med	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inappropriate chair adjustment	94. Train worker to properly adjust chair: - adjust back rest to support lower back; - pull chair forward and lean back while working; - attach a small pillow to back rest to support lower back.	✓		low	med	med
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med to high	med	med
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	med	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	med	med

Case Study 7 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Seat pan on chair is too deep	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med	med	med
	• Inadequate foot support causes person to not lean against back rest • Chair too high causes person not lean against back rest	76. Provide footrest: • provide a footrest which allows both the heels and toes to be supported; • a footrest can be a purchased item ; • a box or several ring binders taped securely together can also be used; • a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred); • a footrest should be large enough to allow the feet to move freely (a size of 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓	✓	med to high low to med	med low	med low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
	Working with large documents (e.g., large drawings and CAD print-outs)	4. Angle work surface to bring work closer to the body and the eye: - provide work surfaces to support large documents; - drawings that are frequently moved or written on should be placed on an angled work surface (like a drawing board); - drawings that are used for reference can be hung vertically; - the goal is to position the document in a more upright position and close to the monitor screen if it is used in conjunction with computer tasks.	✓		low to med	med	med

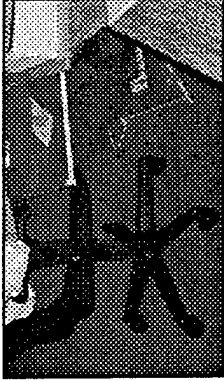
Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Repeated bending	Reaching for items too far from body  Figure 7.14	35. Move items in work zone.	✓		low	med	med
	Working with large documents (e.g., large drawings and CAD print-outs)	4. Angle work surface to bring work closer to the body and the eye: - provide work surfaces to support large documents; - drawings that are frequently moved or written on should be placed on an angled work surface (like a drawing board); - drawings that are used for reference can be hung vertically; - the goal is to position the document in a more upright position and close to the monitor screen if it is used in conjunction with computer tasks.	✓		low to med	med	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
17. Lifting forces	Rarely occurs	N/A					
18. No foot support	- Chair too high - Feet are unsupported	28. Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms. 76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low	low	low

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	Feet are not supported	76. Provide footrest: - a footrest can support the feet and simultaneously reduce pressure on the back of the leg; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).  Figure 7.15	✓		low to med	low	low

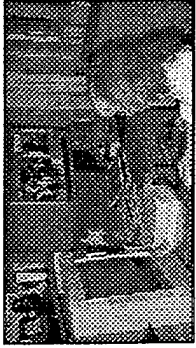
Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28. Lower chair: • adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; • care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
	• Seat pan has a hard front edge	94. Train worker to properly adjust chair: • provide a cushion for the seat pan to prevent contact with hard edge.	✓		med	low	low
		78. Provide proper chair: • provide a chair with a rounded front edge on the seat pan.		✓	med to high	low	low
	• Seat pan too long	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		med	low	low
				✓	med to high	med	med

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Obstructions under work surface interfere with leg clearance and expose person to hard edges: - pencil drawers; - keyboard trays; - or structural supports.	89. Remove clutter from under work surface: - eliminate obstructions; - remove pencil drawers; - replace problem keyboard trays with trays that do not expose person to hard edges.		✓	low to high	med	med
20. Hard floor surfaces	Rarely occurs	N/A					
21. Kneeling/squatting	Rarely occurs	N/A					

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity	
22. Staring at screen or document	Length of work task without a change of position for the eyes	46. Periodically look away from screen.	✓		low	low	low	
		13. Incorporate health comfort strategies: - encourage the person to relax while working – breath frequently – alternate tasks; – stretch; – take rest pause.	✓		low	low	low	
23. Glare	- Glare directly from a light source: looking towards an uncovered window - Glare from an uncovered window reflected off monitor or other shiny surfaces  Figure 7.16	53. Place the monitor perpendicular to the window.	✓		low to med	med	med	
		8. Close blinds or curtains: provide window coverings if not available.	✓		low	med	med	
		60. Position the monitor between						

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- source: looking towards an overhead light - Glare from an overhead or task light reflected off monitor or other shiny surfaces	- rows of overhead lights: - position monitor so that no overhead lights are visible directly above the monitor when looking at the screen; - place the workstation so that it faces a wall or partition.	✓	✓	low to med	med	med
	 Figure 7.17	31. Lower light levels: remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area.		✓	low to med	med	med
		20. Install parabolic louvers to direct light down on the surface: provide alternative light fixtures for overhead lights (parabolic louvre fixtures are recommended when computer work is the pre-dominant activity.) Note: this should be performed by the appropriate personnel.		✓	high	med	med
		79. Provide screen hood/visor.	✓		low	med	med
		93. Tilt monitor down so that the screen is vertical.	✓		low	med	med

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Task light shines into eyes  Figure 7.18	9. Cover or turn out under-cabinet lighting: - cover the task light to prevent it from shining into eyes. 40. Move monitor out from under-cabinet lighting. 10. Direct task light away from screen and eyes: - if necessary, provide a more easily adjustable task light.	✓		low	low	low
			✓		low	low	low
			✓		low	med	med
					low	low	low

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			Minor Modification	Major Change		Quality	Productivity
24. Light levels	- Light levels too high around monitor - Light level too low to read document	31. Lower light levels: - turn off task light; 20-50 fc is an appropriate range of light levels for computer tasks; - remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area; - provide alternative light fixtures for overhead lights (parabolic louvre fixtures are recommended when computer work is the pre-dominant activity.) Note: this should also be performed by the appropriate personnel; - if light levels for the monitor are adjusted appropriately, it may still be necessary to increase light levels for paper tasks using a task light/desk lamp.	✓	✓	med to high	med	med

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		82. Provide task light: - provide task light (50-100 fc is an appropriate range of light levels for reading tasks); - increase overall light levels to meet the lighting needs of computer and paper tasks (50 fc is an appropriate light level where both computer and paper tasks are performed).		✓	low to med	med	med
25. Screen Distance	Monitor positioned too close to eyes	58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: 22"-24" (55.88 - 60.96 cm) is a good distance for many people.	✓		low	med	med
	Not enough work surface space to position monitor far enough away from person	52. Place monitor on alternative work surface.		✓	med	med	med
	Monitor positioned too far from eyes	58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: 22"-24" (55.88 - 60.96 cm) is a good distance for many people.	✓		low	med	med

Case Study 7 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Uncorrected visual disorders	6. Check eyes and correct for visual disorders: provide computer glasses for person's who need bifocals, provide monofocal or tri-focal computer glasses.		✓	med to high	med	med
26. Difficult to read	Font/character size too small to read on computer screen	12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point is recommended for screen distances of 18"-30" (45.72-76.2 cm); - font sizes of greater than 12 point are recommended for screen distances of greater than 30".	✓		low	med	med
	- Document text too small - Document text is hand written or hard to read - VDT screen dirty.	12. Improve character size and style on document and monitor: increase character size. 7. Clean screen regularly.	✓	✓	low low to high low	med med med	med med med

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CASE STUDY - 8 Filing/General Administrative**TASK TITLE: Filing**

Task Description:	Filing and general administrative may involve the use of a cart, a computer and a stacks of files. Typical jobs in which filing is performed include (not necessarily limited to): • medical records • customer service • general administrative support
Job Performance Measures Most often impacted by Filing:	Error rates; number of files retrieved and replaced in the shelves.
Typical Employee Comments about Filing:	Employees typically complain about discomfort and/or stiffness in the back/torso, legs/feet, hands/wrists, arms, and shoulders/neck.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	• Pulling files above shoulder height	109. Use step stool to access high level shelves. 29. Lower items below shoulder height: • minimize handling of heavy or bulky items to and from overhead shelves; • for example, avoid placing heavy binders that are used frequently in overhead storage. Place these items on the regular worksurface or on a sturdy table or shelf.	✓		low	low	med
2. Repeated reaching	• Pulling/pushing/lifting items that are too low (below knee level)	87. Raise work surface: • avoid lifting heavy items (e.g., boxes of copier paper) from floor level; • place heavy items on sturdy tables or shelves. 26. Locate heavy items between knuckle and elbow height: • middle shelves on a storage shelf should be reserved for the heaviest items; • provide tables or storage between knuckle and elbow height for heavy items.	✓	✓	low to high	med	med to high
			✓		low to med	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		25. Locate frequently retrieved items between knee and shoulder height.	✓		low	med	med
• Pulling/pushing/lifting items that are too high (above shoulder height) (see Figure 8.1)	 Figure 8.1	29. Lower items below shoulder height: • minimize handling of heavy or bulky items to and from overhead shelves; • for example, avoid placing heavy binders that are used frequently in overhead storage. Place these items on the regular workspace or on a sturdy table or shelf.	✓		low to high	med	med to high
		26. Locate heavy items between knuckle and elbow height: • middle shelves on a storage shelf should be reserved for the heaviest items; • provide tables or storage between knuckle and elbow height for heavy items.	✓		low to med	low	low
		25. Locate frequently retrieved items between knee and shoulder height.	✓		low	med	med
		111. Use step stool to access high shelves.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Pulling/pushing/lifting items that are too far away from body	34. Move items closer to body: - for example, slide items closer to the edge of a table before lifting. 95. Train proper body mechanics/posture: - encourage person to keep the load as close to the body as possible while lifting/pushing/pulling; - move as close to the load as possible before lifting.	✓		low	med	med to high
3. Shrugging: working with the shoulders shrugged	Rarely occurs	N/A			low to med	med	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
4. Repeated arm forces	Pulling files requires high forces For example, shelves or files that are overstuffed can cause high forces to place and remove items.  Figure 8.2	104. Use available cart to move boxes, files etc.:	✓		low to high	low	med to high
		handle heavy items on carts.					
		95. Train proper body mechanics:	✓		low	low	low
		- encourage person to avoid rushing while handling items; - allow adequate time to perform the task safely.					
		70. Provide adequate storage:		✓	low to med	low	med to high
		eliminate unnecessary items from storage in order to increase available space.					
		11. Group frequently used items together for convenient retrieval:					
		provide easy access for the most frequently used items by storing infrequently used items elsewhere.	✓		low	low	med

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
5. Holding/ carrying materials	Carrying and holding stacks of files  Figure 8.3	104. Use available cart to move boxes, files etc.: - handle heavy items on carts; - provide appropriate sized carts for handling items in cramped spaces.	✓		low	low	med
6. Cradling the telephone between the neck and shoulder	Rarely occurs	N/A					
7. Head bent down, up, or neck twisted	Rarely occurs	N/A					

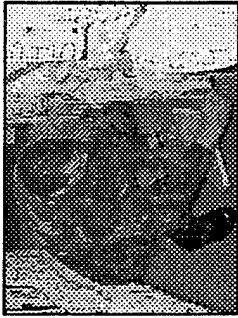
Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	Rarely occurs	N/A					
9. Repeated wrist movements	Placing files onto shelves and carts	95. Train proper body mechanics: - encourage person to maintain a straight wrist while handling items; - position body or item to improve wrist position while handling.	✓		low	low	low
10. Repeated finger movements	Rarely occurs	N/A					
11. Hyper-extension of finger/thumb	Rarely occurs	N/A					
12. Hand forces	- Pulling files requires high hand forces - For example, shelves or files that are overstuffed can cause high forces to place and remove items - Item is difficult to grasp and hold	95. Train proper body mechanics: - encourage person to avoid rushing while handling items; - allow adequate time to perform the task safely; - encourage person to use two hands to handle items whenever possible. 70. Provide adequate storage: - eliminate unnecessary items from storage in order to increase available space; - provide easy access for the most	✓		low to high	low	med to high

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		frequently used items by storing infrequently used items elsewhere.					
		113. Use well fitting gripper gloves to pull files.	✓		low to med	low	med
13. Hard edges	• Hard edges on boxes or files	113. Use well fitting gripper gloves to pull files.	✓		low to med	low	med
14. Repeated forearm motion	• Rarely occurs	N/A					

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward/no back support	Items positioned too low on shelves (below knuckle height)  Figure 8.4	24. Kneel to access low level shelves.	✓		low to high	med	med
		87. Raise work surface: - avoid lifting heavy items (e.g., boxes of copier paper) from floor level; - place heavy items on sturdy tables or shelves.	✓		low to med	low	med
		26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items.	✓		low to med	low	low
		25. Locate frequently retrieved items between knee and shoulder height.	✓		low	low	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		95. Train proper body mechanics: encourage person to use the legs rather than the back to bend;	✓		low	low	low
16. Repeated bending	Reaching for items too far from body	34. Move items closer to body: for example, reduce or eliminate obstructions that prevent person from being closer to work.	✓		low to high	med	med
		95. Train proper body mechanics/posture: - encourage person to keep the load as close to the body as possible while lifting/pushing/pulling; - move as close to the load as possible before lifting.	✓		low	med	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
17. Lifting forces	Handling heavy items while bent and/or reaching for boxes, stacks or paper or files	26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items. 34. Move items closer to body: - for example, slide items closer to the edge of a table before lifting. 104. Use available cart to move boxes, files etc.: - handle heavy items on carts; - provide appropriate sized carts for handling items in confined spaces. 95. Train proper body mechanics: - encourage person to avoid rushing while handling items; - allow adequate time to perform the task safely.	✓	✓	low to med	low to med	med to high
18. No foot support	Rarely occurs	N/A			low	low	low

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or worksurface presses into legs	Rarely occurs	N/A					
20. Hard floor surfaces	Standing and walking on hard surfaces	110. Use proper footwear: - use shoes with comfortable, compressible soles. 72. Provide anti-fatigue mats: - provide an anti-fatigue mat for areas where persons stand for long periods of time.	✓		med to high	low	med
21. Kneeling/ squatting	Shelves positioned too low	78. Provide proper chair: provide a low rolling stool to allow person to sit while accessing low shelves.		✓	med to high	low	med

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Rarely occurs	N/A					
23. Glare	Rarely occurs	N/A					
24. Light levels	Rarely occurs	N/A					
25. Screen Distance	Rarely occurs	N/A					
26. Difficult to Read	Rarely occurs	N/A					

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CASE STUDY - 9 Use of Calculator/Numeric Key Pad

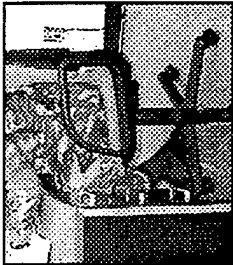
TASK TITLE: Use of Calculator/Numeric Key Pad

Task Description:	Use of calculator or the numeric key pad may involve a traditional keyboard, calculator, or an adding machine. The length of task time varies significantly for calculating tasks. Information used for calculating typically comes from a hard copy (such as a file, single sheets, cards, or computer print outs). Typical jobs in which calculating is performed include (not necessarily limited to): • heavy data entry • finance • contracts
Job Performance Measures Most often impacted by Use of Calculator/Numeric Key Pad:	Error rates, number of records/documents processed
Typical Employee Comments about Use of Calculator/Numeric Key Pad:	Employees most often comment on their concern over the repetitive nature of the keying task. A great deal of media attention is given to keying and this seems to bring the employee attention here. Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms and shoulders/neck.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	- Calculator too high - Calculator/numeric pad too far away from the body - Chair positioned too far away	85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the calculator; - a footrest may be required to support the person's feet.	✓		low	low	low
		30 Lower tray or work surface: set the height of the work surface so that the person's elbows are at the same height as the calculator.	✓		low to med	low	med
		35. Move item in work zone: position calculator so that the forearm can be supported during keying.	✓		low	low	low
		34. Move item closer to body: - prioritize the location of items on the workstation according to frequency of use; - if the calculator is used with high frequency, it should be moved closer to the body.	✓		low	low	low
		33. Move chair closer to work surface.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Arms of chair interfere with moving chair closer  Figure 9.1	90. Remove or lower armrests: - remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation. 78. Provide proper chair: - provide a chair in which the armrests can be adjusted or removed.	✓		low to med	low	med
	Lack of leg clearance under desk	89. Remove clutter from under work surface.	✓	✓	med	low	low
	Reaching to retrieve paper tape record from calculator	34. Move item closer to body: - prioritize the location of items on the workstation according to frequency of use; - if the calculator is used with high frequency, it should be moved closer to the body.	✓		low	low	low

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Repeated reaching	Holding up pages of a multi-page reference document	57. Position document on document support: - provide a mechanical holder for pages; - separate pages in document so that pages can be viewed one at a time; - investigate electronic storage of documents.	✓		low to med	med	med
3. Shrugging: working with the shoulders shrugged	Rarely occurs	N/A					
4. Repeated arm forces	Rarely occurs	N/A					
5. Holding/carrying materials	Rarely occurs	N/A					
6. Cradling the telephone between the neck and shoulder	Rarely occurs	N/A					

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
7. Head Bent down, up, or neck twisted	- Person tends to look at keys or calculator readout while using the calculator - Document positioned flat on work surface	96. Train proper keying style: encourage person to practice looking at the document while keying (i.e., learn not to look at keys while typing.)	✓		low	med	med
		12. Improve character size and style: provide an alternative calculator which has a read out which is easy to see.		✓	med to high	med	med
		4. Angle work surface to bring work closer to the body and the eye: - if document is manipulated frequently or written on, an inclined work surface is preferred; - the inclined surface should be able to be moved easily and, preferably, adjustable in incline; - the inclined surface needs a stop at the bottom to hold papers; - the inclined surface can be a purchased accessory or it can be made by taping several empty 3-ring binders together and taping a clip board or a piece of cardboard at the bottom to hold the papers.		✓	med to high	med	med

Case Study 9 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Document is too far away or is too far to the side - Uncorrected visual disorders cause the person to lean forward to read documents - Monitor and keypad not aligned	34. Move items closer to body: - prioritize the location of items on the workstation according to frequency of use; - those items used frequently should be positioned closer to the body for easy access. 6. Check eyes and correct for visual disorders: - encourage person to have visual disorders corrected. 65. Position numeric pad in front of monitor.	✓		low	low	low
			✓		med to high	med to high	med to high
			✓		low	low	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	• Calculator too high • Work surface too high	30. Lower work surface/keyboard tray: • if the work surface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse; • this is the preferred strategy because it doesn't require a foot rest.	✓		low to med	low	med
		85. Raise chair: • set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse; • This strategy is best when the work surface is not easily adjustable in height; • a footrest may be required to support the person's feet.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Keypad is sloped towards the person	49. Place keyboard and mouse on work surface: - adjust the keypad support surface so the keypad is flat and level; - this can be done by placing a stable object under one side of the keypad in order to level it.	✓	✓	med	low	med
	Person rests wrists on front edge of the calculator or the work surface immediately in front of the calculator	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying ; - encourage person to avoid bending the wrists while resting the hands.	✓		low	med	med
		18. Install palm rest: a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;	✓		low	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		a palm rest is only necessary if there is not another comfortable place to rest the hands without having to bend the wrists.					
	Person constantly rests wrists on the wrist rest while keying	96. Train proper keying style: - encourage person to maintain straight wrists while keying; - encourage person to keep wrists free while keying; - encourage person to use an arm movement to move around on the keyboard rather than a wrist movement; - encourage person to avoid bending the wrists while resting the hands; - rest hands in lap or on arm rests while pausing.	✓		low	med	med
		18. Install palm rest: a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;	✓		low	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Leaning forward while using keypad.	generally, a palm rest which is approximately the same height as the keys will achieve this.					
	Leaning forward while using keypad.	95. Train proper body mechanics: - encourage person to rest the back against the back rest while using the keypad; - this reduces the tendency to bend the wrists back while keying.	✓		low	low	med
9. Repeated wrist movements	Rarely occurs	N/A					
10. Repeated finger movements	- Keying speed and length of task. - Length of task without a work break.	67. Program macro keys to reduce keying: macros are small programs that can be useful for highly repetitive keying or mousing actions.	✓		low	high	high
		95. Train proper body mechanics posture: encourage the person to avoid rushing.	✓		low	low	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		13. Incorporate health comfort strategies: – breath frequently – alternate tasks – stretch – take rest pauses 88. Redesign job: • adjust job activities to distribute keying activities through out the day; • break up continuous keying and mousing tasks with other types of tasks.	✓		low	med	med
11. Hyperextension of finger/thumb	• Person has tendency to hyperextend fingers or thumbs while keying	98. Train proper mousing style: • encourage person to avoid extending fingers while mousing or keying; • encourage person to keep all of the fingers curled under and together.	✓		low	low	low
12. Hand forces	• Person tends to hit keys hard.	96. Train proper keying style: • encourage person to practice using as light a touch as possible on keys.	✓		low	low	low

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Keys are stiff	22. Investigate use of alternative keyboard: provide a keypad with keys which do not require excessive forces to actuate.	✓	✓	med to high	med	med
	Lack of appropriate tactile feedback (e.g., a "click").	22. Investigate use of alternative keyboard: keys should provide adequate auditory and tactile feedback when actuated.		✓	med to high	med	med
		15. Install alternative mouse: mouse buttons should provide adequate auditory and tactile feedback when actuated.		✓	low to high	low	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	Wrists rest on edge of work surface (see Figure 9.2)  Figure 9.2	30. Lower work surface: set the height of the work surface so that the person's elbows are at the same height as the calculator.	✓		low to med	low	med
		85. Raise chair: - set the height of the chair so that the person's elbows are at the same height as the calculator; - a footrest may be required to support the person's feet.	✓		low	low	low
		36. Move keyboard forward so forearms rest evenly on surface: this reduces the tendency to rest the wrists/forearms on the hard edge.	✓		low	low	low
		18. Install palm rest: the hard edge can be eliminated by attaching a rounded edge to the front edge of the work surface. This option is generally preferred over the use of a palm rest;	✓		low	med	med

Case Study 9 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Hard arm rests	a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;					
		94. Train worker to properly adjust chair: attach padding to the armrests to eliminate exposure to hard edges.	✓		low	low	low
		78. Provide proper chair: provide a chair with padded armrests.		✓	med	low	low
14. Repeated forearm rotation	Rarely occurs	N/A					

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	- Text is difficult to read - Person has the unconscious habit of leaning forward while working	12. Improve character size and style on document and monitor: - increase font size of text; - font size of at least 12 point is recommended for screen distances of 18"-30" (45.72-76.2 cm); - font sizes of greater than 12 point are recommended for screen distances of greater than 30" (76.2 cm).	✓		low	med	med
		95. Train proper body mechanics: - encourage person to rest the back against back rest and sit back and relax while working; - encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	low	med

Case Study 9 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inappropriate chair adjustment	94. Train worker to properly adjust chair: - adjust back rest to support lower back; - pull chair forward and lean back while working; - attach a small pillow to back rest to support lower back.	✓		low	low	low
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med	low	low
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.	✓		low to med	low	med
		78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med	low	low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
• Seat pan on chair is too deep	• Inadequate foot support causes person to not lean against back rest	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med	med	med
		81. Provide footrest: • provide a footrest which allows both the heels and toes to be supported; • a footrest can be a purchased item ; • a box or several ring binders taped securely together can also be used; • A footrest of one height may not be appropriate for all sized individuals or workstations (foot rests with several heights or are adjustable in height are preferred); • a footrest should be large enough to allow the feet to move freely (a size of 16" x 20" (40.64 cm X 50.8 cm) is recommended).	✓		low to med	low	low

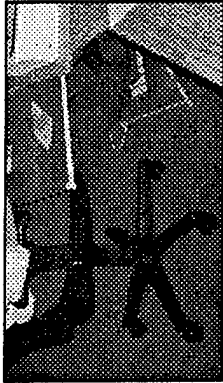
Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28. Lower chair: adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; care must be given to ensure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
16. Repeated bending	Reaching for items too far from body 	35. Move items in work zone.	✓		low	low	med
17. Lifting forces	Rarely occurs	N/A					
18. No foot support	Chair too high	28. Lower chair: adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Feet are unsupported	76. Provide footrest: - provide a footrest which allows both the heels and toes to be supported; - a footrest can be a purchased item or a box or several ring binders taped securely together; - a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred); - a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm x 50.8 cm) is recommended).	✓		low to med	low	low

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	Feet are not supported	76. Provide footrest: a footrest can support the feet and simultaneously reduce pressure on the back of the leg.	✓		low to med	low	low
		 Figure 9.4 28. Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Seat pan has a hard front edge	94. Train worker to properly adjust chair: • provide a cushion for the seat pan to prevent contact with hard edge.	✓		low	low	low
		78. Provide proper chair: • provide a chair with a rounded front edge on the seat pan.		✓	med	low	low
	• Seat pan too long	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓		low to med	med	med
	• Obstructions under work surface interfere with leg clearance and expose person to hard edges: – pencil drawers; – keyboard trays; – or structural supports.	89. Remove clutter from under work surface: • eliminate obstructions; • remove pencil drawers; • replace problem keyboard trays with trays that do not expose person to hard edges.	✓		low	low	med
20. Hard floor surfaces	• Rarely occurs	N/A					

Case Study 9 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
21. Kneeling/ squatting	Rarely occurs	N/A					

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Length of work task without a change of position for the eyes	46. Periodically look away from screen/document.	✓		low	low	low
		13. Incorporate health comfort strategies: – breath frequently – alternate tasks – stretch – take rest pauses	✓		low	med	med
23. Glare	- Glare directly from a light source: looking towards an uncovered window - Glare from an uncovered window reflected off surfaces - Task light shines into eyes	8. Close blinds or curtains: provide window coverings if not available.	✓		low to high	med	med
		9. Cover or turn out under-cabinet lighting: - cover the task light to prevent it from shining into eyes; - replace under-cabinet lighting with an adjustable desk lamp.	✓		low	low	low
		40. Move monitor out from under-cabinet lighting.	✓		low	med	med

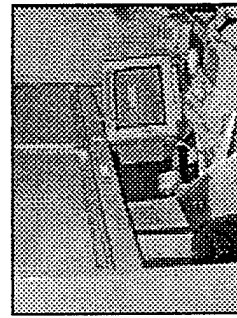


Figure 9.5

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
24. Light levels	Light level too low to read document	82. Provide task light: - provide task light (50-100 fc is an appropriate range of light levels for reading tasks); - increase overall light levels to meet the lighting needs of computer and paper tasks (50 fc is an appropriate light level where both computer and paper tasks are performed).	✓		low to med	med	med
25. Screen distance	Rarely occurs	N/A					
26. Difficult to read	- Document text too small - Document text hand written hard to read	12. Improve character size and style on document and monitor: - increase size of text on hard copy; - improve clarity of text on hard copy.	✓		low	med	med

CASE STUDY - 10 Lifting/pushing/pulling

TASK TITLE: Lifting/pushing/pulling

Task Description:	Lifting, pushing and pulling may involve the use of a cart, items of varying weights and sizes (such as boxes of paper, stacks or paper or files) and placement of items at varying heights and locations (floor/shelves or a work surface). Typical jobs in which lifting/pushing/pulling is performed include (not necessarily limited to): • office supplies and distribution • copying and sorting • general administrative support
Job Performance Measures Most often impacted by Lifting/pushing/pulling:	Error rates, number of items retrieved and distributed
Typical Employee Comments about Lifting/pushing/pulling:	Employees typically complain about discomfort and/or stiffness in the back/torso, legs/feet, hands/wrists, arms, and shoulders/neck.
Suggested Level II Analysis:	Biomechanical Lifting Analysis, NIOSH Analysis.

Case Study 10 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	Rarely occurs	N/A					
2. Repeated reaching	Pulling/pushing/lifting items that are too low (below knee level)	87. Raise work surface: - avoid lifting heavy items (e.g., boxes of copier paper) from floor level; - place heavy items on sturdy tables or shelves. 26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items. 25. Locate frequently retrieved items between knee and shoulder height.	✓		low	low	med
			✓		low	low	med
			✓		low	low	med

Case Study 10 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Pulling/pushing/lifting items that are too high. (above shoulder height) (see Figure 10.1)	29. Lower items below shoulder height: - minimize handling of heavy or bulky items to and from overhead shelves; - for example, avoid placing heavy binders that are used frequently in overhead storage. Place these items on the regular work surface or on a sturdy table or shelf.	✓		low	low	med
	 Figure 10.1	26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items.	✓		low	low	med
		25. Locate frequently retrieved items between knee and shoulder height.	✓		low	low	med
		111. Use step stool to access high shelves.	✓		low to med	low	med

Shoulder/Neck

Job Factor	Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Pulling/pushing/lifting items that are too far away from body	34. Move items closer to body: • for example, slide items closer to the edge of a table before lifting. 95. Train proper body mechanics/posture: • encourage person to keep the load as close to the body as possible while lifting/pushing/pulling; • move as close to the load as possible before lifting.	✓		low	med	med
3. Shrugging: working with the shoulders shrugged	• Rarely occurs	N/A					
4. Repeated arm forces	• Repetitive handling of heavy items • Items require high forces to remove and replace (e.g., shelves or files that are overstuffed can cause high forces to place and remove items)	104. Use available cart to move boxes or files: • handle heavy items on carts. 95. Train proper body mechanics: • encourage person to avoid rushing while handling items; • allow adequate time to perform the task safely.	✓		low	med	med
		70. Provide adequate storage: • eliminate unnecessary items	✓		low to high	low	med

Case Study 10 (continued)

Shoulder/Neck

Job Factor	Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		from storage in order to increase available space.					
		11. Group frequently used items together for convenient retrieval: provide easy access for the most frequently used items by storing infrequently used items elsewhere.	✓		low	low	med
5. Holding/ carrying materials	- Carrying materials for long-distances. - Carrying heavy materials. - Carrying items in confined or tight spaces.	104. Use available cart to move boxes or files: - handle heavy items on carts; - provide appropriate sized carts for handling items in confined spaces.	✓		low	med	med
6. Cradling the telephone between the neck and shoulder	Rarely occurs	N/A					
7. Head bent down, up, or neck twisted	Rarely occurs	N/A					

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent Wrists	Rarely occurs	N/A					
9. Repeated wrist movements	Stocking shelves with items of various weights and sizes	95. Train proper body mechanics: - encourage person to maintain a straight wrist while handling items; - position body or item to improve wrist position while handling.	✓		low	low	med
10. Repeated finger movements	Rarely occurs	N/A					
11. Hyper-extension of finger/thumb	Rarely occurs	N/A					
12. Hand forces	- Repetitive handling of heavy items - Items require high forces to remove and replace. (e.g., shelves or files that are overstuffed can cause high forces to place and remove items) - Item is difficult to grasp and hold	104. Use available cart to move boxes, files etc.: - handle heavy items on carts. 95. Train proper body mechanics: - encourage person to avoid rushing while handling items; - allow adequate time to perform the task safely; - encourage person to use two hands to handle items whenever possible. 70. Provide adequate storage:	✓		low	med	med
			✓		low	low	med
			✓		low to	low	med

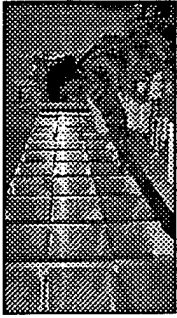
Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		- eliminate unnecessary items from storage in order to increase available space; - provide easy access for the most frequently used items by storing infrequently used items elsewhere.			high		
		113. Use well fitting gripper gloves to pull files.	✓		low to med	low	med
13. Hard edges	Hard edges on boxes or files	113. Use well fitting gripper gloves to pull files.	✓		low to med	low	med
14. Repeated forearm rotation	Rarely occurs	N/A					

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward/no back support	Items positioned too low (below knuckle height)	87. Raise work surface: - avoid lifting heavy items (e.g., boxes of copier paper) from floor level; - place heavy items on sturdy tables or shelves.	✓		low	low	med
		26. Locate heavy items between knuckle and elbow height. - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items.	✓		low	low	med
		25. Locate frequently retrieved items between knee and shoulder height.	✓		low	low	med
		95. Train proper body mechanics: - encourage person to use the legs rather than the back to bend; - encourage person to arch the lower back while lifting.		✓	low	low	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Repeated bending	Reaching for items too far from body (see Figure 10.2)  Figure 10.2	34. Move items closer to body: for example, reduce or eliminate obstructions that prevent person from being closer to work.	✓		low	med to high	med
		95. Train proper body mechanics/posture: - encourage person to keep the load as close to the body as possible while lifting/pushing/pulling; - move as close to the load as possible before lifting.	✓		low	low	med
17. Lifting forces	Handling heavy items while bent and/or reaching for boxes, stacks or paper or files	26. Locate heavy items between knuckle and elbow height: - middle shelves on a storage shelf should be reserved for the heaviest items; - provide tables or storage between knuckle and elbow height for heavy items.	✓		low	low	med
		34. Move items closer to body: for example, slide items closer to the edge of a table before lifting.	✓		low	med to high	med

Case Study 10 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		104. Use available cart to move boxes, files etc.: • handle heavy items on carts; • provide appropriate sized carts for handling items in confined spaces.	✓		low	med	med
		95. Train proper body mechanics: • encourage person to avoid rushing while handling items; • allow adequate time to perform the task safely.	✓		low	low	med
18. No foot support	Rarely occurs	N/A					

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or worksurface presses into legs	Rarely occurs	N/A					
20. Hard floor surfaces	Standing and walking on hard surfaces	110. Use proper footwear: - use shoes with comfortable, compressible soles; - provide an anti-fatigue mat for areas where persons stand for long periods of time.	✓		med	low	med
21. Kneeling/ squatting	Rarely occurs	N/A					

Case Study 10 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Rarely occurs	N/A					
23 Glare	Rarely occurs	N/A					
24. Light levels	Rarely occurs	N/A					
25. Screen Distance	Rarely occurs	N/A					
26. Difficult to read	Rarely occurs	N/A					

CASE STUDY - 11 Microscope Work

TASK TITLE: Microscope Work

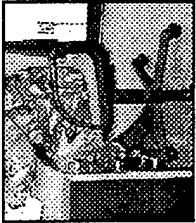
Task Description:	The type of microscope on which this case study is based is the traditional two eye-piece microscope with focus and adjustment controls. The length of time preparing and examining slides varies significantly for microscope tasks as well as the type of work that is typically performed. Typical jobs in which microscope work is performed include (not necessarily limited to): • hospital laboratories • environmental testing laboratories
Job Performance Measures Most often impacted by Microscope Work:	Error rates, number of slides examined and identified
Typical Employee Comments about Microscope Work:	Employees most often comment on their concern over the repetitive nature of microscope work. Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, shoulders/neck, and head/eyes.
Suggested Level II Analysis:	Postural analysis, light level analysis.

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	• Microscope/work surface too high	30. Lower work surface: • set the height of the microscope so that the microscope controls are about half way between resting elbow height and shoulder height.	✓		low	low	med
	• Chair positioned too low	85. Raise chair: • set the height of the chair so that the microscope controls are about half way between resting elbow height and shoulder height; • be sure to provide adequate support for the feet.	✓		low	low	low
	• Person reaches to write on document which is too far away on work surface	35. Move item in work zone: • move the document closer to the edge of the work surface; • items which are used every few minutes or more should be placed close to the body.	✓		low	med	med
	• Person does not rest the hand while writing	18. Install palm rest: • provide a place for the person to rest the hand while writing; • encourage the person to rest the hand while writing.	✓		low	low	low

Case Study 11 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	- Chair positioned too far away - Arms of chair or other obstructions interfere with moving chair closer  Figure 11.1	37. Move microscope closer to edge. 90. Remove or lower armrests: - remove or adjust armrests or obstructions if they prevent the person from moving close enough to the workstation. - attach armrests as extensions to the worksurface. 78. Provide proper chair: - provide a chair in which the armrests can be adjusted or removed.	✓	✓	low	low	low
	Lack of leg clearance under desk	89. Remove clutter from under work surface.	✓		low	med	med
	Items used frequently not positioned close to the body	35. Move item in work zone: items which are used every few minutes or more should be placed closest to the body.	✓		low	med	med
	Items used frequently not positioned close to the body	35. Move items in work zone. Provide foot controlled focusing mechanisms to reduce reaching associated with frequent control adjustments.	✓		low	med	med
2. Repeated reaching							

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		34. Move items closer to body: • prioritize the location of items on the workstation according to frequency of use; • those items which are more frequently used should be closer to the body and more easily accessible	✓		low	med	med
3. Shrugging: working with the shoulders shrugged	• Microscope too high	30. Lower work surface: • set the height of the microscope so that the microscope controls are about half way between resting elbow height and shoulder height.	✓		low	low	med
	• Chair positioned too low	85. Raise chair: • set the height of the chair so that the microscope controls is about half way between resting elbow height and shoulder height; • be sure to provide adequate support for the feet.	✓		low	low	low
4. Repeated arm forces	• Rarely occurs	N/A					
5. Holding/ carrying materials	• Rarely occurs	N/A					

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
6. Cradling the telephone between the neck and shoulder	Rarely occurs	N/A					
7. Head Bent down, up, or neck twisted	- Eye piece on microscope is too low - Chair too high - Eye piece on microscope is at an inappropriate angle	87. Raise the work surface: - set the height of the microscope so that the eye piece is at eye height. - change the eyepiece height to enable the worker to sit with the head upright. 28. Lower chair - set the height of the chair so that the work surface is about half way between resting elbow height and shoulder height 4. Angle work surface to bring work closer to the body and the eye: - adjust the angle of the microscope; - provide a microscope with an adjustable eye piece.	✓	✓	low to med	low	med
			✓		low	low	med
			✓		low	low	med
				✓	high	med	med

Case Study 11 (continued)

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Data recording sheets are positioned flat on work surface. (see Figure 11.2)  Figure 11.2	4. Angle work surface to bring work closer to the body and the eye: - if data collection sheet is manipulated frequently or written on, an inclined work surface is preferred; - the inclined surface should be able to be moved easily and, preferably, adjustable in incline; - the inclined surface needs a stop at the bottom to hold papers; - the inclined surface can be a purchased accessory or it can be made by taping several empty 3-ring binders together and taping a clip board or a piece of card board at the bottom to hold papers.	✓		med	med	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	• Microscope controls too high • Microscope controls are at an inappropriate angle	30. Lower work surface: • set the height of the microscope so that the microscope controls are about half way between resting elbow height and shoulder height.	✓		low to med	low	med
	• Chair is too low	85. Raise chair: • set the height of the chair so that the microscope controls is about half way between resting elbow height and shoulder height; • be sure to provide adequate support for the feet.	✓		low	low	med
		88. Redesign job: • break up continuous microscope tasks with other types of tasks.		✓	low to med	med	med
	• Person rests wrists on table while operating controls.	95. Train proper body mechanics posture: • encourage person to maintain straight wrists while using controls; • encourage person to keep wrists free while using controls; • encourage person to avoid bending the wrists while resting the hands.	✓		low	low	low

Case Study 11 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		14. Install adjustable forearm rests: • an arm rest can provide a comfortable place to rest the arms so that the worker doesn't need to rest on the wrists • build up the surface immediately under the controls so wrists rest on a surface without being bent.	✓		low	low	low
9. Repeated wrist movements	• Rarely occurs	N/A					
10. Repeated finger movements		88. Redesign job: • break up continuous microscope tasks with other types of tasks.		✓	low to med	med	med
11. Hyper-extension of finger/thumb	• Rarely occurs	N/A					
12. Hand forces	• Gripping the controls too hard.	96. Train proper body mechanics: • encourage person to practice using as light a grip as possible on the controls.	✓		low	low	low

Case Study 11 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	Wrists rest on edge of work surface	18. Install palm rest: - the hard edge can be eliminated by attaching a rounded edge to the front edge of the work surface. - a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;	✓	✓	low to med	low	low
		38. Move microscope forward so forearms rest evenly on surface: this allow the person to minimize contact with a hard edge.	✓		low	low	low
		94. Train worker to properly adjust chair: attach padding to the armrests to eliminate exposure to hard edges.	✓		low	low	low
		78. Provide proper chair: provide a chair with padded armrests.		✓	med to high	low	low
14. Repeated forearm rotation	Rarely occurs	N/A					

Case Study 11 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	Eye piece on microscope is too low	87. Raise work surface: set the height of the microscope so that the eye piece is at eye height.	✓		low to med	low	med
	Chair too high	28. Lower chair: set the height of the chair so that the work surface is about half way between resting elbow height and shoulder height.	✓		low	low	med
	Eye piece on microscope is at an inappropriate angle	4. Angle work surface to bring work closer to the body and the eye: - adjust the angle of the microscope; - provide a microscope with an adjustable eye piece.	✓		low	low	med
	Data recording document positioned flat on work surface.	4. Angle work surface to bring work closer to the body and the eye: - if document is handled, flipped or written on, an inclined work surface is preferred; - the inclined surface should be able to be moved easily and, preferably, adjustable in incline;	✓	✓	high	med	med

Case Study 11 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		- the inclined surface needs a stop at the bottom to hold papers; - the inclined surface can be a purchased accessory or it can be made by taping several empty 3-ring binders together and taping a clip board or a piece of card board at the bottom to hold the papers.					
	Person has a habit of leaning forward while working	95. Train proper body mechanics: - encourage person to rest the back against back rest and sit back and relax while working; - encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.	✓		low	med	med
	Inappropriate chair adjustment	94. Train worker to properly adjust chair: - adjust back rest to support lower back; - attach a small pillow to back rest to support lower back.	✓		low	med	med

Case Study 11 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Inadequate chair	78. Provide proper chair: - provide a chair with a back rest; - provide a chair with adequate lower back support.		✓	med to high	med	med
	Chair arms interfere with moving chair closer	90. Remove or lower armrests: - remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation. - attach auxiliary armrests as extensions to the worksurface.	✓		low to med	med	med
	Seat pan on chair is too deep	78. Provide proper chair: provide a chair in which the armrests can be adjusted or removed.		✓	med to high	med	med
		75. Provide back support: - attach a pillow to back rest to decrease the seat pan depth and support the lower back; - provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.	✓	✓	low	med	med

Case Study 11 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or foot ring on the stool; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
16. Repeated bending	Reaching for items too far from body  Figure 11.3	35. Move item closer to body: - position items so they can be reached without leaning forward; - prioritize the location of items on the workstation according to frequency of use.	✓		low	med	med
17. Lifting forces	Rarely occurs	N/A					
18. No foot support	Chair too high	28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low

Case Study 11 (continued)

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	Feet are unsupported	76. Provide footrest: - adjust height of foot ring on chair (e.g., build up with wood, if not adjustable) - provide a footrest which allows both the heels and toes to be supported;	✓		low to med	low	low

Case Study 11 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	Feet are not supported	76. Provide footrest: - adjust height of foot ring on chair (e.g., build up with wood, if not adjustable). - provide a footrest which allows both the heels and toes to be supported.	✓		low to med	low	low
		28 Lower chair: - adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest; - care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.	✓		low	low	low
		94. Train worker to properly adjust chair: provide a cushion for the seat pan to prevent contact with hard edge.	✓		low to med	low	low
		78. Provide proper chair: provide a chair with a rounded front edge on the seat pan		✓	med to high	med	med

Case Study 11 (continued)

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Seat pan too long	75. Provide back support: • attach a pillow to back rest to decrease the seat pan depth and support the lower back; • provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.		✓	med	low	low
	• Obstructions under work surface interfere with leg clearance and expose person to hard edges: - pencil drawers; - or structural supports.	89. Remove clutter from under work surface: - eliminate obstructions - remove pencil drawers - move position of microscope (sideways) to eliminate interference with under-table obstructions.	✓	✓	low to med	med	med
20. Hard floor surfaces	• Rarely occurs	N/A					
21. Kneeling/squatting	• Rarely occurs	N/A					

Case Study 11 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	Length of work task without a change of position for the eyes	45. Periodically look away from microscope to change the task demand on the eye and focus on an object of varying distance	✓		low	med	med
		13. Incorporate health comfort strategies: - alternate tasks - stretch - take rest pauses	✓		low	med	med
23. Glare	- Glare directly from a light source: looking towards an uncovered window - Task light shines into eyes	8. Close blinds or curtains: provide window coverings if not available.	✓	✓	low	med	med
		9. Cover or turn out under-cabinet lighting: replace under-cabinet lighting with an adjustable desk lamp.		✓	low to med	med	med

Case Study 11 (continued)

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
24. Light levels.	Light level too high or too low to use microscope	31. Lower light levels: Equalize light levels entering "microscope eye" and eye exposed to room light.		✓	low to med	med	med
25. Screen distance	Rarely occurs	N/A					
26. Difficult to read	Detail difficult to see in microscope	12. Improve visibility: provide a more powerful, better quality microscope;		✓	low	med	med

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APPENDIX 5

Recommendations

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APPENDIX 5

This Appendix corresponds with Step 5: Recommendations. It provides information on:

- Implementing Minor Modifications (Section A.5.1);
- Using Design Criteria to Implement Major Purchases (Section A.5.2); and
- a Sample Completed Level I Ergonomics Assessment Summary and Recommendations form.

The *Implementing Minor Modifications* section provides you with guidance on how to actually make or implement the minor modifications - changes and adjustments to existing workstations, chairs, equipment, etc. - that you would have already identified using the case studies. The "Implementation Reference" column on the Corrective Action List refers directly to the information provided in this section. The information complements that provided in the case studies and it will be helpful each time you apply the Level I process.

The *Using Design Criteria to Implement Major Purchases* section is to be used in situations where you are asked to provide ergonomics criteria for selecting a new, potentially major piece of equipment such as a chair, monitor support, or other item. Since the focus of this section is on design and selection criteria for major purchases, and since a shop may not be able to implement this type of recommendation right away, you may only need this in special situations. Each time you do an assessment, you may still want to make the shop supervisor aware that you can provide assistance in helping to evaluate future purchases to help them select equipment with features that provide the most benefit to employees while providing the most value to the shop. Again, the "Implementation Reference" column on the Corrective Action List refers directly to information provided in this section.

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IMPLEMENTING MINOR MODIFICATIONS

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A.5.1 IMPLEMENTING MINOR MODIFICATIONS

This section is presented as a concise “how-to” manual for constructing (or working toward) an ergonomically correct workstation given different types of furniture, different types of tasks, and different sizes of people.

A.5.1.1 Adjusting Administrative Workstations. When contemplating changes to a computer workstation, the initial evaluation needs to focus on the posture of the employee. Figure A.1 illustrates the recommended posture for computer work. Note the following:

- Front edge of work surface perpendicular to the employee’s line of vision.
- Monitor directly in front of employee.
- Front edge of work surface wide enough for keyboard (and mouse pad if in use).
- Mouse directly adjacent to keyboard.

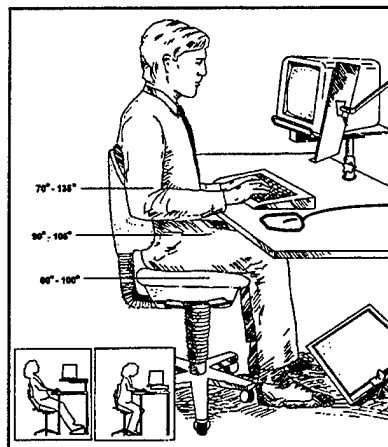


Figure A.1
Recommended Posture for Computer Work

It is important to provide appropriate space such that equipment can be accommodated and flexibility to perform a variety of job tasks is maintained. Most importantly, the configuration needs to provide adequate space to allow the employee to change postures frequently throughout the day.

An important goal is to make each workstation as flexible as possible for performing the required tasks. To that end, the following guidelines are provided.

- Single-height surface workstations tend to be more flexible than multiple-height surface workstations.
- Employees should have the option of using a palm rest and/or pushing the keyboard back at least 10 inches (25.4 cm) on the work surface so that resting the forearms on the work surface is possible.
- Corner workstations are usually preferred by intensive computer users because they take advantage of dead space by placing monitors in corners of workstations to provide the maximum workspace. However, a monitor should only be placed in a corner workstation if the workstation is designed as a corner workstation.
- Traditional desk-shape configurations will properly accommodate a monitor only if at least 30 inches (76.2 cm) of depth exists.

A.5.1.2 Task Types. The type of task performed determines the requirements of the furniture and workstation.

- **Keying and Paper Tasks Combined**

For tasks that involve substantial writing and referring to multiple documents in addition to keying, the workstation needs to have enough workspace to allow the employee to simultaneously perform paper tasks and computer tasks. This generally indicates that the work surface should be larger than for data entry tasks. The total depth of the workstation generally should be at least equal to 20-22 inches (50.8 to 55.88 cm), plus the overall depth of the monitor (including clearance for cabling and ventilation).

For example, for a monitor which is 17 inches (43.18 cm) in overall depth, the total workstation depth should be at least 37 inches (93.98 cm).

- **Keying and Paper Tasks Separate/Data Entry Only**

If the employee's tasks involve primarily keying and data entry with little additional paperwork performed simultaneously (e.g., the employee performs primarily data entry tasks from a single document) then less work surface is required.

The total depth of the workstation generally should be at least equal to 8-10 inches (20.32 to 25.4 cm) plus the overall depth of the monitor (including clearance for cabling and ventilation).

For example, for a monitor which is 17 inches (43.18 cm) in overall depth, the total workstation depth should be at least 25 inches (63.5 cm).

A.5.1.3 Correct Work Heights

A.5.1.3.1 The “Bottom- Up” Strategy. In order to take advantage of the bottom-up strategy, the employee must have the following equipment:

- A height-adjustable work surface (note: adjustments may need to be made by maintenance personnel)
- A work surface that is no more than 2 inches (5.08 cm) thick.
- A chair in which the seatpan is adjustable in height 16 to 20.5 inches (40.64 to 52.07 cm).

If these conditions exist, try the following procedure to correctly position the height of the chair.

- **Step 1:** Have the employee set the chair height so that:
 - a) The employee can comfortably place heels and toes simultaneously on the floor;
 - b) The employee’s weight is distributed evenly across the legs (avoid creating pressure on underside of knees or on buttocks). This is usually characterized by the thighs being parallel to the floor (horizontal); and
 - c) A substantial portion of the employee’s upper body weight is supported by the back rest.

The recommended position is shown in Figure A.2

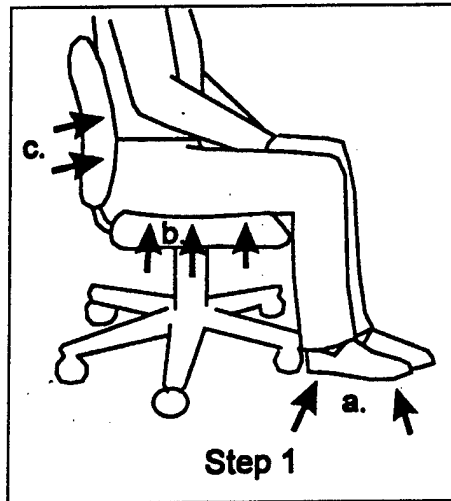


Figure A.2
Correct Work Height
Bottom-Up Strategy

- **Step 2:** Set the workstation height so that the home row of the keyboard is at elbow height and the forearms are horizontal. The goal is to allow the person to key with the wrists straight. This usually means that you need to get the work surface as low as possible without interfering with leg clearance as shown in Figure A.3.

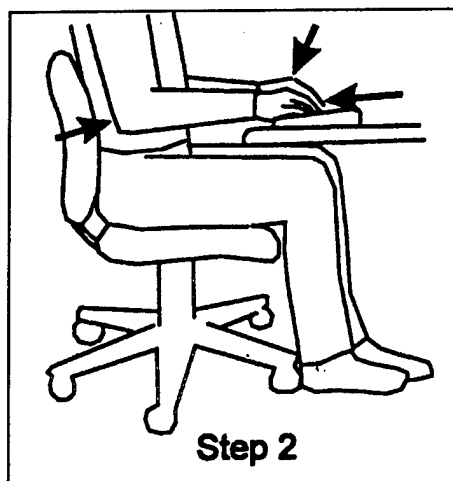


Figure A.3
Correct Keyboard Height
Bottom-Up Strategy

This strategy is generally preferred for providing the correct work heights. Because the use of a footrest is not required, the employee can move around the workstation more freely.

A.5.1.3.2 The “Top-Down” Strategy. In order to take advantage of the top-down strategy, the employee must have the following equipment:

- A work surface that is fixed in height between 28 and 30 inches (71.12 and 76.2 cm)
- A work surface that is no more than 2 inches (5.08 cm) thick
- A chair in which the seatpan is adjustable in height with a range of at least 16 to 20.5 inches (40.64 to 52.07 cm)
- A footrest which is at least 2 inches in height (with the ability to raise the overall height of the footrest to at least 6 inches (15.24 cm))

If these conditions exist or can be created, use the following procedure to correctly position the height of the employee:

Step 1: Set the seatpan height so that the home row of the keyboard is at elbow height and the forearms are horizontal (the goal is to allow the person to key with their wrists straight). This usually means that you want to raise the person as high as possible without interfering with leg clearance as shown in Figure A.4.

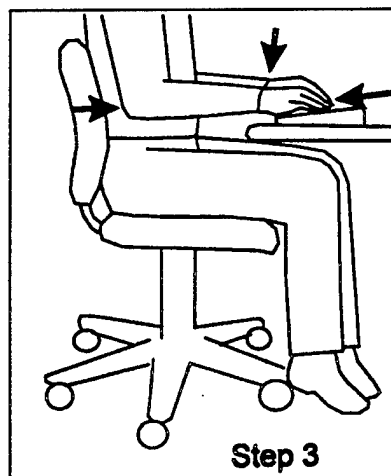


Figure A.4
Correct Positioning for the “Top Down” Strategy

Step 2: Adjust the footrest to the appropriate height so that (See Figure A.5):

- a) The employee can comfortably place heels and toes simultaneously on the floor;
- b) the employee's weight is distributed evenly across the legs (avoid concentrating pressure on underside of knees or on buttocks). This is usually characterized by the thighs being parallel to the floor (horizontal); and
- c) a substantial portion of the employee's weight is supported by the back rest.

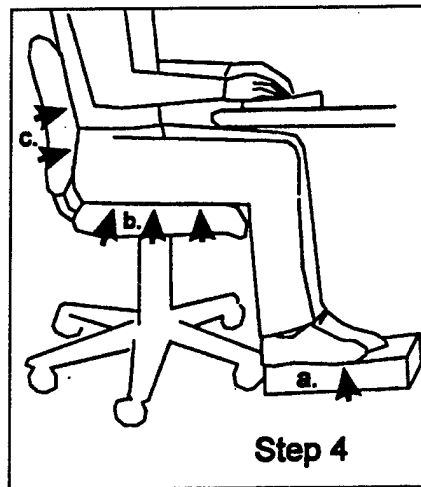


Figure A.5
Adjusting the Footrest Height
Top-Down Strategy

If the work surface height is fixed and is lower than 28 inches (71.12 cm), it may be necessary to raise the entire workstation for larger employees to provide sufficient leg clearance. One disadvantage to this approach is that the use of a footrest may restrict mobility at the workstation, since support is only available where the footrest is located. This method is less effective for small employees because of the height of the feet from the floor, and it may encourage twisting while reaching for items at workstation because feet are on footrest. As a result, this method works best if the employee does not have to frequently move around the workstation.

A.5.1.4 Adjusting the Chair. In order to properly adjust the chair, you must evaluate how the employee's body fits with the depth of the seat pan, and the height and the tilt of the back rest. You can usually adjust all three to accommodate the employee and increase comfort.

- **To Adjust the Depth of the Seat Pan**

When assisting the employee:

- Adjust the seat pan so that it supports the entire length of the thigh and buttocks without placing pressure on the back of the knee
- Check the adjustment. The employee should be able to insert no more than two fingers between the back of the knee and the front edge of the seat pan.

- **To Adjust the Height of the Back Rest**

When assisting the employee, adjust the back rest so:

- The back rest supports the lower lumbar region of the back
- The lumbar support is close to the employee's waist as shown in Figure A.6
- The outward lumbar curvature is not positioned in the middle or upper back regions.

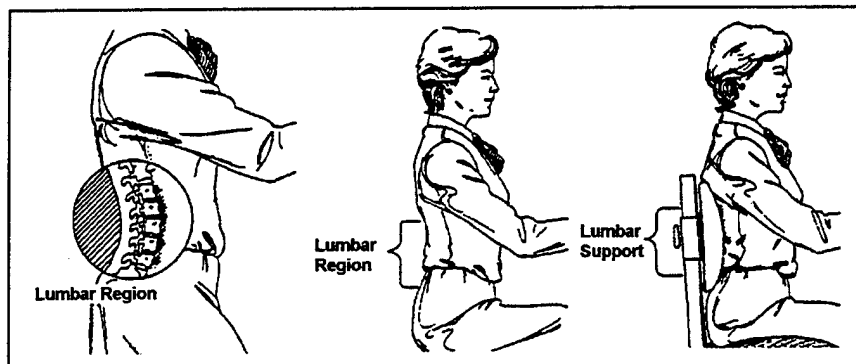


Figure A.6
Positioning for the lumbar support

- **To Adjust the Tilt of the Seat Back**

When adjusting the tilt and tension of the seat back:

- The employee should be encouraged to allow the seat back to tilt back so that he/she can lean against the back rest while working
- Set the appropriate tension; a lighter tension on the seat back tilt will make it easier to lean back in the chair.

A.5.1.5 Adjusting the Monitor/Documents

- **Adjust the Monitor Height (refer to Figure A.7)**
 - Raise or lower the monitor (use books, blocks, etc.) so that the top line of text on the screen is no higher than eye level. The bottom of the screen should not be below 60 degrees downward from eye level.
 - For bifocal wearers, place the monitor directly on the work surface so they can view it at a downward angle.

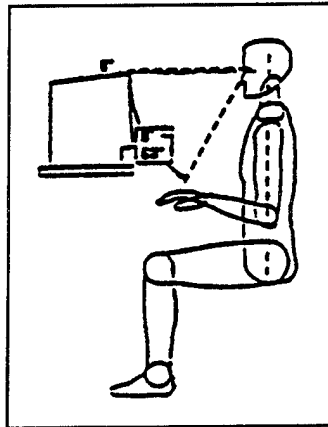


**Figure A.7
Proper Monitor Height**

- **Adjust the Eye-to-Monitor Distance**
 - The eye-to-monitor distance to between 18-30 inches (45.72 to 76.2 cm) (22 to 24 inches (55.88 to 60.96 cm) is comfortable for most employees) can be obtained by sliding the monitor backward or forward.
 - If the work surface is not deep enough, consider adding an articulating keyboard tray.

- **Adjust Light Levels**

For best conditions when working at a computer workstation minimize ambient light. This can be accomplished by adjusting ambient light sources to provide between 20-50 foot candles (200-500 lux) of light overall. Eliminate light bulbs, if necessary, but only in pairs. Task lights can be added inside the workstation to increase lighting for paper tasks (if necessary) to provide between 50-100 (500-1000 lux) foot candles on the documents.

- **Adjust the Document Location**

- Provide a document holder (e.g., sometime propping up the document on a 3-ring binder will do until a proper holder can be obtained) if the employee frequently keys information directly from a document.
- Provide an angled work surface for intensive writing tasks.

- **Adjust the Position of the Monitor**

Placement of the monitor to avoid glare is also critical. You can accomplish this by:

- Moving the monitor so it is perpendicular to windows and between light fixtures (caution: do not place the monitor directly below a shelf that has lighting under it)
- Adjusting the monitor height and tilt to redirect spectral glare from ceiling fixtures or task lighting
- Encouraging the employee to adjust window coverings frequently during the day
- Encouraging the employee to remove excess white paper posted or lying about the immediate workarea of the monitor screen
- Creating and attaching a monitor hood (provide anti-glare screens only as a last resort).

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USING DESIGN CRITERIA TO IMPLEMENT MAJOR PURCHASES

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A.5.2 USING DESIGN CRITERIA TO IMPLEMENT MAJOR PURCHASES

In this section, design criteria has been "converted" into evaluation criteria which you may use when selecting new or replacement equipment or furniture. Criteria is provided for:

- Chairs (adjustment ranges, backrest design, armrest design, etc.);
- Work Surfaces (including keyboard surfaces, and layout specifications);
- Storage;
- Footrests;
- Document Holders;
- Wrist/Palm Supports;
- Monitor Supports;
- Task Lighting; and
- Keyboards.

To enable you to use this information correctly and efficiently in the future, a "Product Evaluation Checksheet" is provided for each item. The checksheets are provided at the end of the section as "forms" which you may copy. In the past, some individuals have sent similar checksheets to product manufacturers or vendors to request information on the ergonomics features of their products. The remainder of this section provides you with the important information upon which the checksheets are based.

A.5.2.1 Criteria for Chairs. Chairs for performing administrative tasks are plentiful, but selecting the chair most appropriate to the task and the person can be a challenge when the requirements are not known up front. For example, chairs are designed to operate effectively based on a load maximum. If heavier employees will be using the chair, the weight range should be specified. The goal, whether you are considering weight or other measures of size, is to accommodate the widest range of people possible. In addition to office chairs being made adjustable, many manufacturers now offer some designs in small, medium, and large sizes.

Not only does the chair need to fit the person, the chair must be appropriate for the task and the work station. For example, if an employee performs a wide variety of tasks at the same work station, flexible/adjustable arm rests may be needed. Armrests, although usually important, may be less critical for other work stations.

Alternative Seating: Other chairs include laboratory stools (used for higher height work stations or desks) or sit-stand chairs. These are generally recommended for shorter tasks or tasks in which the worker is rotated through on a regular (several times a shift) basis. For these alternatives more care and considerations should be taken to fit the best chair to the worker. Stools can have several disadvantages:

1. They can be difficult to mount or dismount and can create a slipping, falling or tripping hazard;
2. They can be difficult to move;
3. They have footrests which typically consists of a metal ring which is not adjustable to different workers; and
4. they are typically not designed for long periods of sitting.

While alternative seating on stools may provide some advantage, you are encouraged to contact AL/OEMO or an expert to discuss the work situation and chair.

There are four major parts to a chair that should be considered. They are:

- 1) Seat Pan;
- 2) Backrest;
- 3) Support Base; and
- 4) Armrests (optional depending on type of work).

A.5.2.1.1 Seat Pan Specifications. The following criteria is recommended for the seat pan. Figure A.8 shows the requirements.

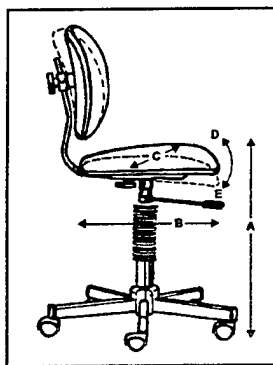


Figure A.8
Seat Pan Specifications

Seat Pan

1. **Height** should be adjustable to accommodate the widest range of employees possible. This range is approximately from 16 to 20.5 inches (40.64 to 52.07 cm) and is measured at the center of the seatpan. Height adjustment is critical as it affects many other work station variables. (Caution: if the chair must be raised to accommodate the work surface for a shorter employee, a footrest may be necessary.)
2. **Depth** of the seatpan is measured from front to back of the seatpan at the longest point. Typical ranges, depending on population, are from 15 to 17 inches (38.1 to 43.18 cm). Seatpans that have greater depth than this generally press into the back of the employees knees.
3. **Width** of the seatpan is measured from side to side of the seatpan perpendicular to the depth. It is measured to the edge of the seat and not the edge of the fabric. Typical ranges, depending on population, are from 18 to 19 inches (45.72 to 48.26 cm).
4. **Angle** of the seatpan with respect to the floor either fixed at 0° or be up to 10° front down. Adjustable seatpans should cover this range. Ensure that if the seat pan is not used at a 0° then a non-slip fabric cover should be provided for safety.
5. **Waterfall front** is the roll-off of the front edge. The amount of roll-off is a function of the height of the chair and the nature of the work being performed. A waterfall front is preferred.
6. **Upholstery** should be breathable. Long-wearing fabrics are commonly wool and wool-blends. These also provide sufficient friction to keep the person from sliding off of the chair under most conditions. (Note: Fabric may not be allowed in specialized environments like biological labs).
7. **Padding** of 1 to 2 inches (2.54 to 5.08 cm) in depth should cover the seat pan and back rest. The padding should be of sufficient quality to remain resilient over years of use.

A.5.2.1.2 Backrest Specifications. The following criteria is recommended when specifying the back rest. Figure A.9 shows these requirements. The backrest needs to be separate from the seat pan and have the characteristics listed below.

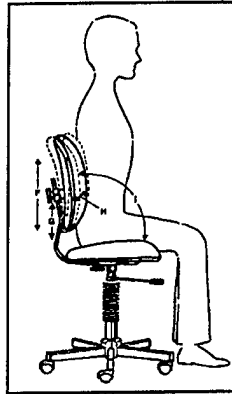


Figure A.9
Backrest

1. **Height** should be adjustable to accommodate the widest range of employees possible. This range is approximately from 12 to 15 inches (30.48 to 38.1 cm) and is measured at the longest vertical range.
2. **Width** of backrest should be a minimum of 12 inches (30.48 cm) in the lumbar region (low back curve or "small of the back").
3. **Vertical placement** should be adjustable over a range of at least 2 to 4 inches (5.08 to 10.16 cm). The top point should be measured from the L3 to L5 range to the seatpan surface, a range of typically 6 to 9 inches (15.24 to 22.86 cm).
4. **Lumbar support** height should be 6-9 inches (15.24 to 22.86 cm) above the seatpan. The lumbar support should be contoured to encourage the appropriate lumbar curve adoption in users.
5. **Tilt forward** adjustment should allow at least 10° of movement forwards (*see Seatpan/backrest angle below*).
6. **Tilt backward** adjustment should allow at least 5° of movement backwards (*see Seatpan/backrest angle below*).
7. **Seatpan/backrest angle** should remain in the area of 90°-105°.
8. **Upholstery** should be breathable, if allowed (biological laboratory where biologic fluids may come into contact with the upholstery). Long-wearing fabrics are commonly wool and wool-blends. These should provide sufficient friction to keep a person from sliding about while using the chair.
9. **Padding** of 1 to 2 inches (2.54 to 5.08 cm) in depth should cover the backrest. The padding should be of sufficient quality to remain resilient over years of use.

A.5.2.1.3 Support Base Specifications. Specifications for the base should include the criteria below.

1. **The Base** should be wide enough and designed such that it is unlikely to tip over when reasonably used. This is typically accomplished using a 5 legged design. Keep in mind that the usual design criteria is at a specific weight for tip over resistance.
2. **Casters**, if utilized, should be of sufficient size and material such that they will not catch or stop when rolling over small particles and function properly on the surface of their intended use. This is important as casters can help or hinder getting into and out of the chair, and mobility. The caster operation should be quiet and smooth.

A.5.2.1.4 Arm Rests Specifications. Care should be taken to ensure that person can get close enough to work area or that they can properly move about with the armrests.

Adjustable armrests should be provided whenever possible. Important features include:

- horizontal movement (extend forward and retract)
- vertical movement (up and down)
- rotation (pivot inward to provide arm support for employees whose hip breadth is significantly wider than shoulder span)

Many manufacturers now offer chairs with adjustable armrests. These types of arm rests can be valuable in solving employee complaints of neck and shoulder fatigue, or where multiple types of tasks occur during the workday from the same chair.

Important features are listed below.

1. **Length** should be approximately 8 inches (20.32 cm). This can change as a function of the task; longer if more precise work is involved and shorter if more dynamic movement is needed.
2. **Upholstery** should be breathable, if allowed.
3. **Width** should be at least 2 inches (5.08 cm) wide and up to 3 inches (7.62 cm) wide.
4. **Height above the seatpan** should be adjustable from 7-12 inches (17.78 to 30.48 cm) to allow support for different tasks, different body types, and to build in opportunities for movement.
5. **Minimum distance between armrests** should be 18 inches (45.72 cm). This distance may need to be increased for larger employees with special needs.

6. **Padding** should be similar to that used for the seatpan and for the backrest. The covering can be a leather, soft plastic, or similar to the upholstery of the rest of the chair.

Unicor Examples of Chairs

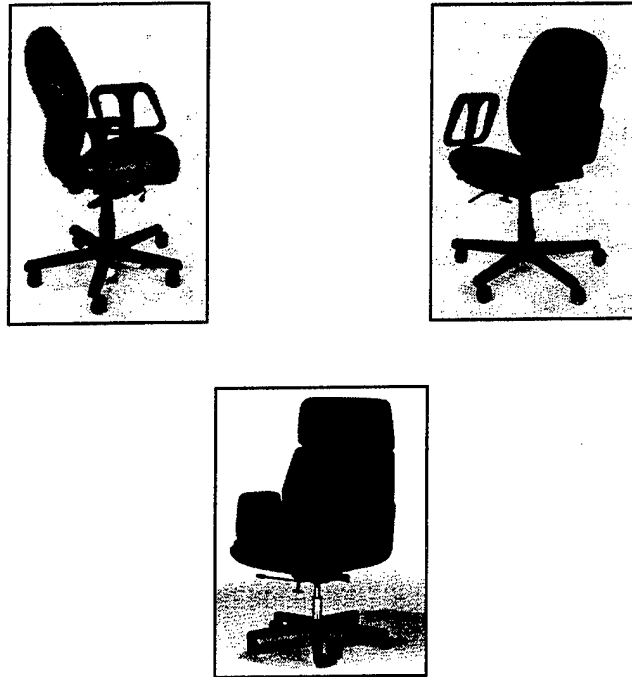


Figure A.10
Unicor Chair Examples

A.5.2.1.5 Knee Space/Clearance Specifications. Clearance envelopes are shapes that are provided in the ANSI/HFS 100-1988 standard. These shapes are scaled to the minimum clearances necessary to accommodate 95th percentile male (e.g. larger employees). When establishing clearance always begin by considering the larger employee.

These clearances do not include adjustments for clothing other than low heel shoes. However normal business clothing is not expected to change the requirements. Adjustments or accommodations should be expected when specialized clothing is required (e.g., the wearing of a G-flight suit, the need for arctic clothing, or the use of other personal protective equipment).

Chair Evaluation Checksheet

Table A.1 presents a checklist to evaluate chairs for a specific job.

A chair evaluation checksheet is provided to help you systematically evaluate various chair designs.

Table A.1
Chair Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Seat Pan	Height	Seat Pan is adjustable between 16.0 - 20.5 inches (40.6 - 52.1 cm.) above the floor			
	Depth	Depth of the seatpan is from 15-17 inches (38.1 - 43.2 cm.)			
	Width	Width of the seatpan from 18-19 inches (45.7 - 48.3 cm.)			
	Angle	Angle of the seatpan with respect to the floor either fixed at 0° or be up to 10° front down.			
	Waterfall	Waterfall front is the roll-off of the front edge.			
	Padding	Padding of 1-2 inches (2.5 - 5.1 cm.) in depth should cover the chair.			
	Upholstery	Upholstery should be breathable.			
Backrest	Height	Backrest height should be adjustable from 12-15 inches (30.5 - 38.1 cm.)			
	Vertical Placement	Backrest vertical placement should be adjustable over a range of 2-4 inches (5.1 - 10.2 cm.)			
	Width	Backrest width should be a minimum of 12 inches (30.5 cm.) in the lumbar region			
	Lumbar Support	Backrest lumbar support should be 6-9 inches (15.2 - 22.9 cm.) above the seatpan.			
	Tilt Forward	Backrest tilt forward should allow at ear 10 degrees of movement.			

Table A.1
Chair Evaluation Checksheet (Cont'd)

Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
	Tilt Backward	Backrest tilt backward should allow at least 5 degrees of movement.			
	Seatpan/backrest angle	Seatpan/backrest angle should remain in an area of 90-105 degrees.			
	Upholstery	Backrest upholstery should be breathable.			
	Padding	Padding of 1-2 inches (2.5 - 5.1 cm.)			
Support Base	Base	Base should have a five castor base of support.			
Armrests	Length	Armrest length should be approximately 8 inches (20 cm.)			
	Upholstery	Upholstery should be breathable.			
	Width	Armrest width should be at least 2 inches (5.1 cm.)			
	Height from Seatpan	Armrest height from seatpan should be adjustable between 7 and 11 inches (17.8 - 28.0 cm.)			
	Minimum Distance between Armrests	Minimum distance between armrests should be 18 inches (45.7 cm.)			
	Padding	Armrests should be padded			
Comments: _____ _____ _____ _____ _____					

A.5.2.2 Criteria for Work Surfaces. The dimensions of the work surfaces should be consistent with the ANSI standards. The selection of a work surface is dependent upon several variables listed below.

- Type and sequence of the work being performed
- Types, number and sizes of equipment and materials
- The layout relationship of the work station in relation to the surrounding work stations.

The work stations that are illustrated on the following pages suggest worksurface layouts for various types of jobs. Ideally workstation layouts and dimensions should be based on specific task requirements.

A Level 1 Assessment should be performed to identify the most appropriate layout for an administrative work station. If multiple tasks are performed by the individual, the critical tasks should be used as the primary basis for work surface design and layout.

Two types of worksurfaces are common: one-level and two-level surfaces. The one-surface level allows for maximum flexibility for placement of keyboards and other input devices. For work stations that have two separate work surfaces, users should be able to adjust one surface lower for keying and another higher for writing and other activities. The overall work surface height should be adjusted to user needs.

The appropriate work station layout considers work zone principles and frequency of equipment and material use. The primary zone is closest to the worker and is for equipment and materials used most frequently or for the longest period of time. The secondary zone is for items that need to be reached or seen on a daily basis, but for shorter periods of time. The reference zone is the area for items occasionally used and usually requires a move from the normal position to access them.

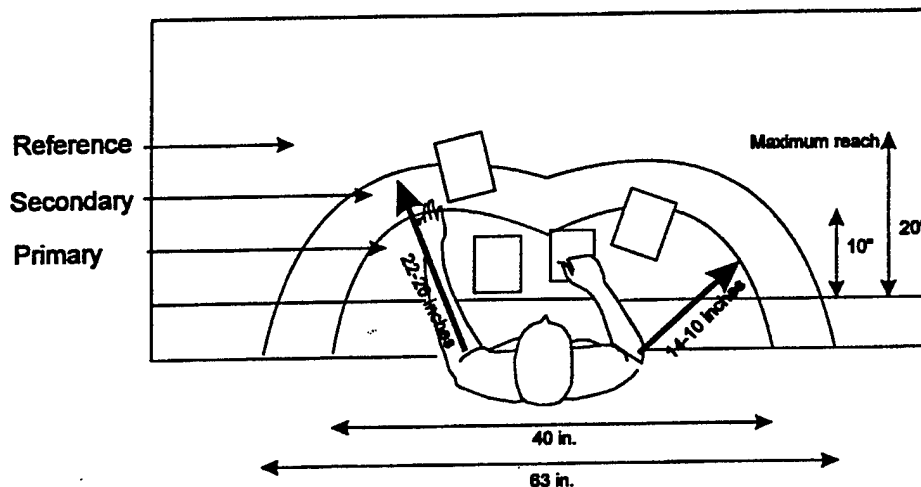


Figure A.11

**Overhead view of the desk surface showing primary, secondary and reference zones
(metric conversion 1 inch=2.54 centimeters)**

- Primary zone: surface area represented by arcs drawn from the shoulders - close reach envelope
- Secondary zone: surface area represented by arcs drawn from the shoulders - far reach envelope
- Reference zone: surface area represented by the grid - exceeds the length of a full reach

Special Needs

There are a number of situations which will require special requirements, in particular, bifocal wearers and users of large-size displays. The work surface needs to accommodate those users.

A.5.2.2.1 Work Surface Specifications. The following additional criteria should be considered when selecting a work surface.

1. All work surfaces should have a matte finish.
2. Work surfaces should be neither black nor white.
3. Edges should be rounded rather than square or sharp.
4. The height of the work surface should be adjustable between 28 and 31.5 inches (71.12 to 80.01 cm).
5. The surface should be available in a variety of widths.
6. The surface should be no more than 2 inches (5.08 cm) thick.
7. The minimum criteria for clearances under work surfaces are:
 - Depth 18 inches (45.72 cm) (to prevent the knees/feet from hitting the back of the desk);
 - Width 28 to 30 inches (71.12 to 76.2 cm) (for side to side leg room);
 - Height 28 to 30 inches (71.12 to 76.2 cm) (between floor and underside of surface);
8. The work surface should be stable.
9. If a work surface is composed of more than one leaf or section, then there should be no gaps between work surfaces.

A.5.2.2.2 Keyboard Support Surfaces. The following additional criteria should be considered when selecting keyboard support surfaces.

1. Height should adjust between 23 to 28 inches (58.42 to 71.12 cm) above the floor. The surface should allow for a 70 - 135 degree angle at the elbow, with the wrist flat.
2. Surface should be no more than 1 inch (2.54 cm) thick.
3. Horizontal depth and width should be determined based on equipment (such as keyboard and mouse).

Note: Articulated keyboard supports/shelves may not be acceptable in some situations.

A.5.2.2.3 Task Specific Work Surface Layouts. The following layouts are provided as a starting point. Not all typing/keying tasks are the same. Therefore some modification or customizing of the layout for specific jobs may be necessary.

Typing/Keying

Typical jobs in which keying is performed include (not necessarily limited to):

- heavy data entry;
- customer service/record keeping; and
- general administrative support.

The recommended “starting point” layout for this job is shown in Figure A.12

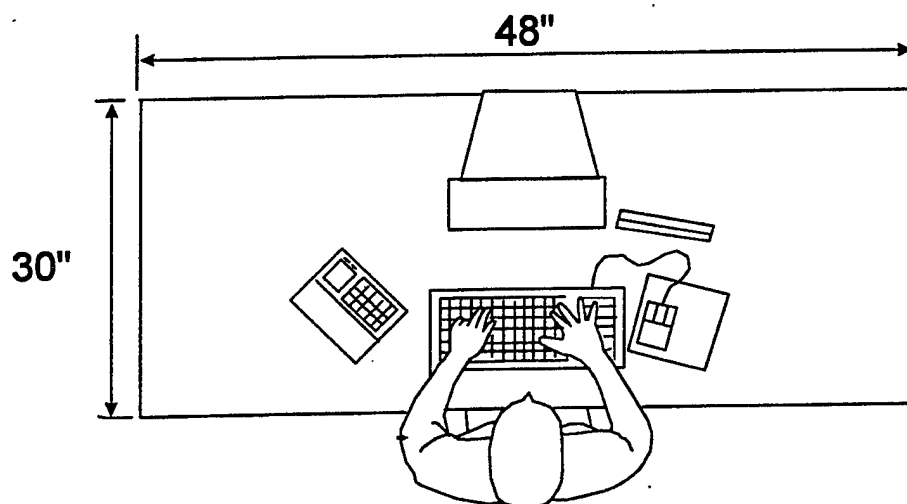


Figure A.12
“Starting Point” Work Surface Layout-Typing/Keying
(metric conversion-1 inch = 2.54 centimeters)

- Writing and Illustrating

Typical jobs in which writing and illustrating is performed include:

- customer service/record keeping contracts
- contracts

The recommended "Starting Point" layout is shown in Figure A.13.

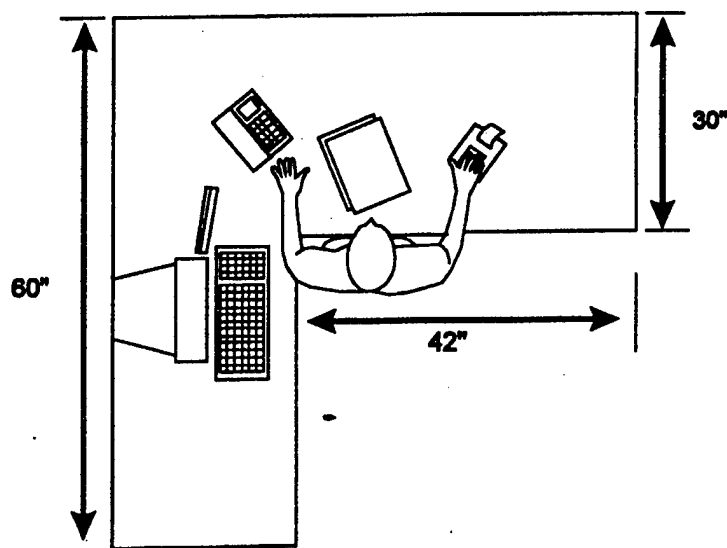


Figure A.13
"Starting Point" Worksurface Layout-Writing/Illustrating
(metric conversion 1 inch=2.54 centimeters)

Mousing

Typical jobs in which mousing is performed include:

- desktop publishing; and
- technical/administrative tasks.

The recommended “Starting Point” layouts are shown in Figure A.14.

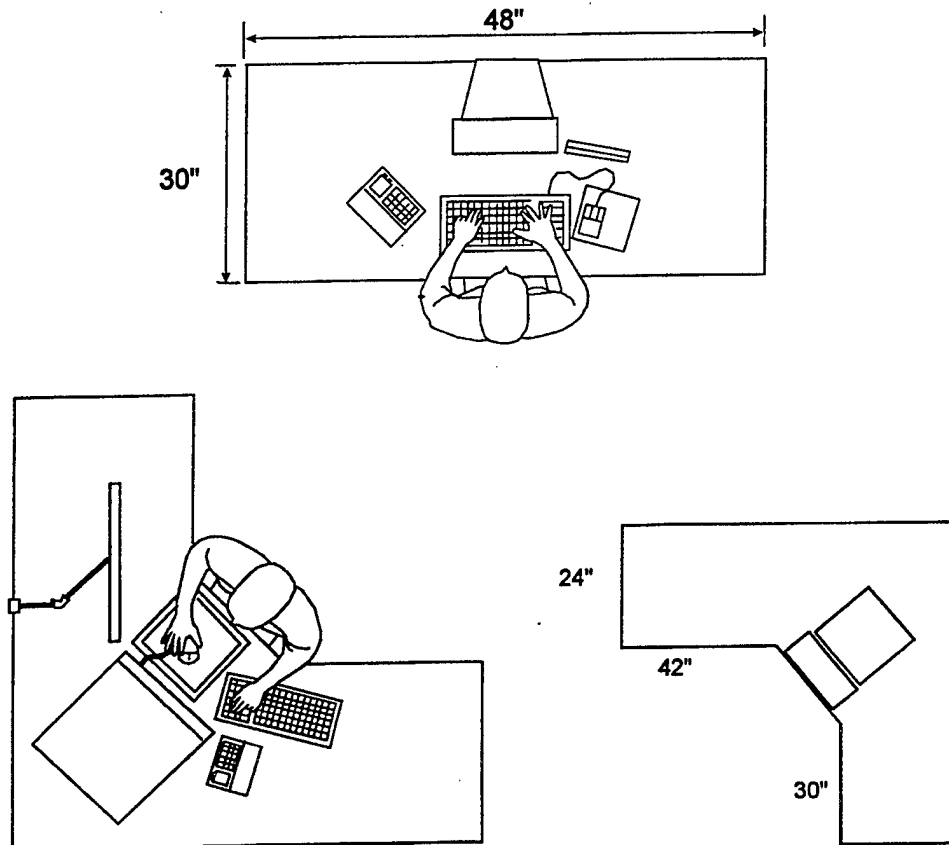


Figure A.14
“Starting Point” Work Surface layout-Mousing
(metric conversion 1 inch=2.54 centimeters)

Monitoring (diligence tasks)

Typical jobs in which monitoring is performed include:

- weather station; and
- radar control.

The recommended "Starting Point" layout is shown in Figure A.15

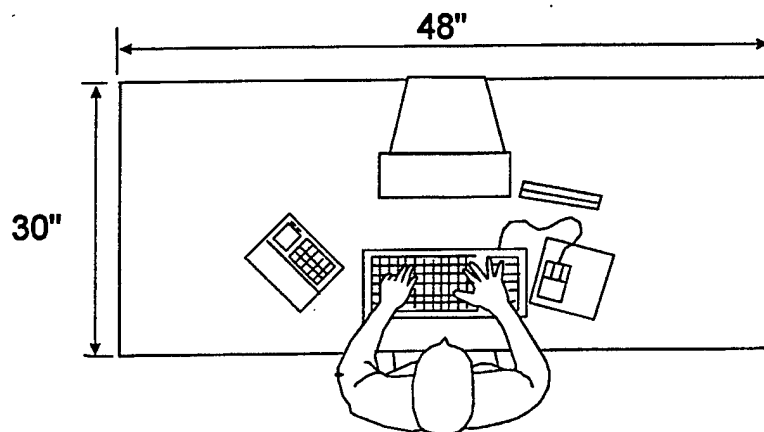


Figure A.15
"Starting Point" Work Surface Layout Diligence Tasks
(metric conversion 1 inch=2.54 centimeters)

Using the Telephone

Typical jobs in which calling is performed include (not necessarily limited to):

- customer service; and
- general administrative support.

The recommended “Starting Point” layout is shown in Figure A.16.

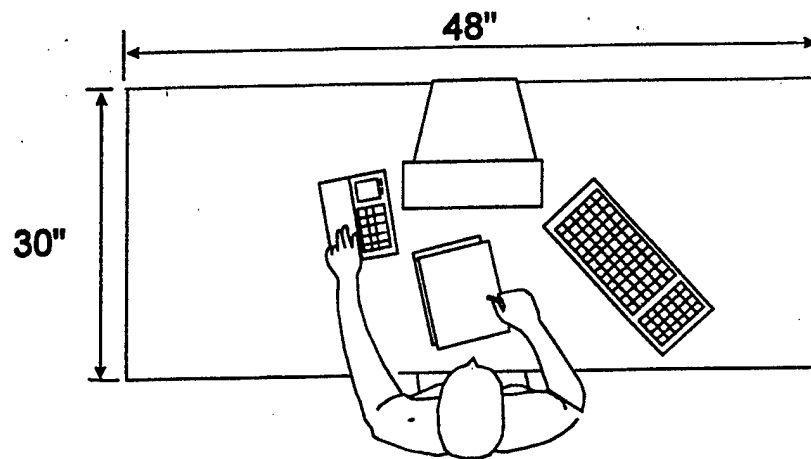


Figure A.16
“Starting Point” Work Surface Layout-Heavy Telephone Use
(metric conversion 1 inch=2.54 centimeters)

CAD Drafting

Typical jobs in which CAD drafting is performed include:

- Engineering; and
- Drafting.

The recommended “starting point” work surface layout for CAD operation is shown in Figure A.17.

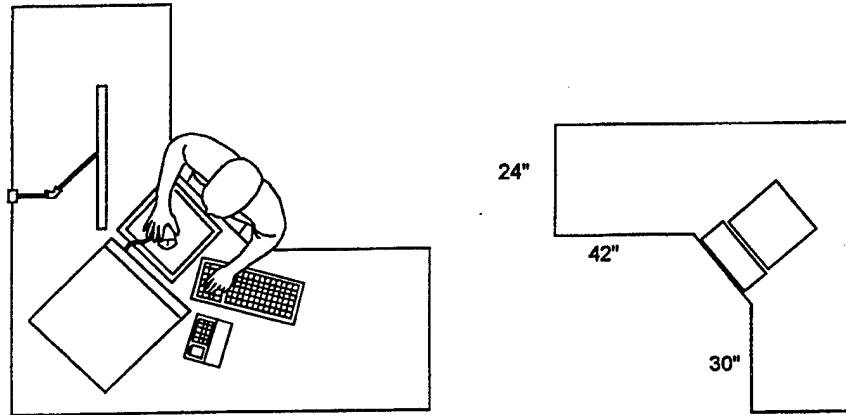


Figure A.17
“Starting Point” Work Station Layout-CAD Operation
(metric conversion-1 inch = 2.54 centimeters)

Calculator or use of numeric key pad

Typical jobs in which calculating is performed include (not necessarily limited to):

- heavy data entry;
- finance; and
- contracts.

The recommended starting point layout station for numeric key pad usage is shown in Figure A.18.

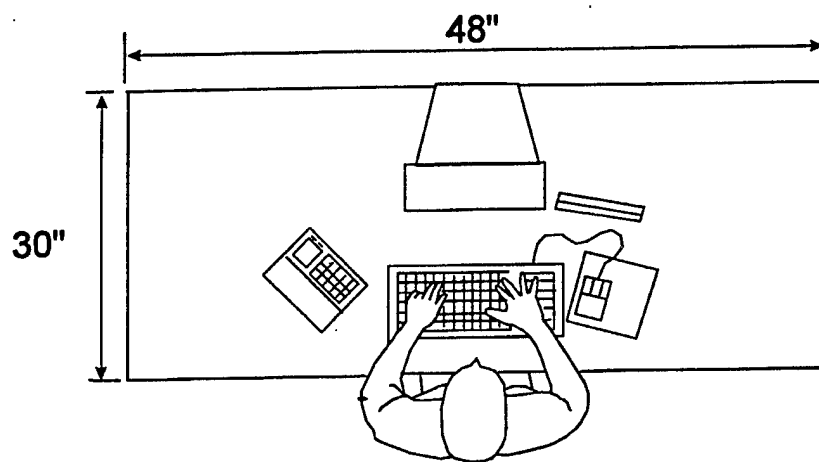


Figure A.18
“Starting Point” Work Station Layout-Numeric Key Pad Use
(metric conversion-1 inch=2.54 centimeters)

Microscope Use

Typical jobs in which microscope work is performed include (not necessarily limited to):

- hospital laboratories; and
- environmental testing laboratories.

The initial design of the microscope work station may be based on that provided for the keying/typing work station - - exchange the microscope for the computer. Due to the special nature of microscope work, a Level I analysis may be required prior to developing a final work station layout. Particular attention must be given to chair height in relation to the microscope to avoid having the user lean forward causing neck fatigue.

Work Surface Evaluation Checksheet

Table A.2
Work Surface Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Work Surface	Finish	Work surface should have a matte finish.			
	Color Finish	Work surface should neither be black nor white.			
	Edges	Edges should be rounded rather than square.			
	Height	Height of the work surface should be adjustable between 28" and 31.5" (71.1 - 80.0 cm)			
	Surface	Surface should be available in a variety of widths.			
	Thickness	Surface should be more than 2" in (5.1 cm) thickness.			
	Clearance under desk	Depth 18" (45.7 cm)			
		Width 28"-30" (71.1 - 76.2 cm.)			
		Height 28"-30" (71.1 - 76.2 cm.)			
	Stability	Surface should be stable.			
	Uniformity	If work surface is composed of more than one leaf or sectioned, then there should be no gaps between work surface.			
Comments:					

A.5.2.3 Criteria for Storage. Storage is an important issue that is often overlooked. Analysis of the workstation needs to focus on the factors listed below.

- Size of storage required, depends on:
 - amount of paper, supplies
 - size of files
 - number and size of reference materials, etc.
 - amount of personal belongings
- Type of storage
 - drawers (size and number)
 - shelves (overhead, free-standing)
- Location
 - frequency of use
- Size and Weight

Specifications for Storage

1. Shelving over the workstation should not be located above 65" (165.1 cm) from the floor.
2. Shelving below the workstation should not be located below 13" (33.02 cm) from the floor.
3. Wall files with top reference indexing should have their information tabs placed between 22 and 52 inches (55.88 and 132.08 cm) from the floor.
4. If an item weighs more than 40 lb. (18.1 kg), it should be stored on a shelf which is no deeper than 20" (50.8 cm) and which is located between 27.5 and 49 inches (69.85 and 124.46 cm) from the floor.
5. The space between a wall and the front of a vertical filing cabinet should be a minimum of 42" (106.68 cm).
6. The space between a wall and the front of lateral filing cabinet should be a minimum of 32" (81.28 cm).
7. The space between a wall and the front of a bookshelf should be a minimum of 36" (91.44 cm).

Storage Evaluation Checksheet

Table A.3 is the Checksheet to which you can use to determine if current storage is adequate or if changes are needed.

Table A.3
Storage Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Shelving	Over Work Station	Shelving over work station should not be located above 65" (165.1 cm.) above the floor			
	Below Work Station	Shelving below work station should not be located below 13" (33.0 cm.) from floor.			
	Wall Files	Wall files with top tabs should have reference tabs placed between 22-52 inches (55.9 - 132.1 cm.) above the floor.			
	Items weighing over 40 lb.	Items weighing more than 40 lb. (18.1 kg.) should be stored on shelves no deeper than 20 inches (50.8 cm.) and located between 27.5-49 inches (69.9 - 124.5 cm.)			
	Space - Vertical Cabinets	Space between a wall and the front of a vertical filing cabinet should be a minimum of 42 inches (106.7 cm.)			
	Space - Lateral Cabinets	Space between wall and front of lateral filing cabinet should be a minimum of 32" (81.3 cm.)			
	Space - Wall and front Bookshelf	Space between a wall and the front of a bookshelf should be a minimum 36" (91.4 cm.)			
Comments: _____					

A.5.2.4 Criteria for Footrests. Footrests provide a wider range of adjustability at a workstation. For small individuals working at fixed work surface height, the footrest is required to support the feet when the chair height is raised to accommodate proper positioning at the keyboard.

For taller individuals, a footrest, although not required, may enable them to assume a variety of positions. In addition, for workers who may be using chairs that do not meet ergonomic standards, a footrest can help promote a neutral seated posture and /or relieve pressure on the underside of the leg. Footrests are often an inexpensive addition which may improve employee comfort in many work stations.

Height and angle adjustable footrests are recommended as they accommodate day-to-day changes in shoe heel height and provide flexibility of moving the footrest between variable workstation heights.

Specification

1. The footrest should sit firmly on the floor without slipping.
2. The footrest should be covered with a non-slip material.
3. The footrest should be at least 20" (50.8 cm) wide.
4. The footrest should be 12" (30.48 cm) deep.
5. A footrest which is adjustable in angle from 10 to 15 degrees is desirable.
6. A footrest which is adjustable in height (approx. 2" (5.1 cm)) is desirable but not mandatory.

Footrest Evaluation Checksheet

Table A.4 is the Footrest Evaluation Checksheet.

Table A.4
Footrest Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Footrest	Width	Footrest should be at least 20" (50.8 cm.) wide			
	Depth	Footrest should be at least 12" (30.5 cm.) deep			
	Angle	Footrest if adjustable should be from 10 to 15 degrees.			
	Height	Footrest if adjustable in height (approximately 2" or 5.1 cm.) is desirable but not mandatory			
	Covering	Footrest should be covered with a non-slip material.			
	Sturdiness	Footrest should sit firmly on the floor without slipping.			
Comments: _____					

A.5.2.5 Criteria for Document Holders. A document holder can assist in accommodating both the musculoskeletal and visual needs of the VDT user. If the device has the appropriate adjustability features, the user can position the document adjacent to the screen or in another viewing position that allows for comfortable postures and visual access. Bifocal wearers usually need the documents placed nearer to the work surface.

Specifications

1. The document holder should have a matte finish.
2. The document holder should be available in size 8.5" X 11" (21.59 X 27.94 cm).
3. A document holder for large documents should be available in size 11" X 14" (27.94 X 35.56 cm).
4. The document holder should have an adequate means of securing the document.

5. The document holder should be stable when attached or placed on the workstation.
6. The device should be adjustable vertically (up/down).
7. The device should be adjustable horizontally (forward/back).

Note: For some tasks, a document holder that is positioned between the keyboard and the monitor may be appropriate.

Document Holder Evaluation Checksheet

Table A.5 is the Checksheet for evaluating document holders.

Table A.5
Document Holder Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
Yes	No				
Document Holder	Size - letter	Document holder should be available in size 8.5" x 11" (21.6 x 27.9 cm.)			
	Size - larger documents	Document holder should be available in 11" x 14" (27.9 x 35.6 cm.)			
	Adjustability	Document holder should be adjustable vertically (up/down)			
		Document holder should be adjustable horizontally (forward/back)			
	Finish	Document holder should have a matte finish.			
	Document Security	Document holder should have an adequate means of securing the document.			
	Stability	Document holder should be stable when attached or placed on the workstation.			
Comments: _____					

A.5.2.6 Criteria for Wrist/Palm Supports. Devices referred to as wrist-rests or palm-supports can be helpful under certain circumstances in dealing with musculoskeletal issues. For optimum comfort, the wrist should be as flat as possible while the person is keying. This position should be achieved by **adjusting the height of the chair in relation to the keyboards home-row keys** rather than relying on a wrist rest. A wrist-rest may be a helpful accessory under the following circumstances:

- The chair cannot be adjusted to the appropriate height;
- The keyboard height exceeds the recommended height 2" (5.1 cm) to home-row);
and
- There is not enough room to position the keyboard back from the edge of the surface.

If a wrist-rest is provided, it should conform to the requirements listed below. In addition, users should be trained to use the wrist-rest when not keying, i.e. at rest.

If a wrist-rest causes the wrist to be extended (bent up more than 10 degrees) or flexed (bet down) while keying, its use should be discontinued because it may restrict movement and lead to further tendon irritation and disorders.

Specifications

No definitive criteria have been established for wrist or palm supports. However, the following guidelines should be considered.

1. The wrist/palm support should be at least 2" (5.1 cm) wide and extend the length of the keyboard.
2. The edges should be rounded and the entire surface padded.
3. The height should not exceed the height of the front of the keyboard to which it is attached.

Wrist/Palm Support Evaluation Checksheet

Table A.6 is the Wrist/Palm Support Evaluation Checksheet.

Table A.6 - Wrist/Palm Support Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Wrist/Palm Supports	Width	Wrist/palm support should be at least 2" (5.1 cm.) wide and extend the length of the keyboard			
	Edges	Edges of wrist/palm support should be rounded and the entire surface padded.			
	Height	The height should not exceed the height of the front of the keyboard.			
Comments: _____					

A.5.2.7 Criteria for Monitor Supports. The primary purpose for supplying monitor support arms is to provide for flexibility and adjustability to address both musculoskeletal and visual issues. These have the following benefits:

- Free up space in existing workstations where work surface space is limited; and
- Increase flexibility/accommodate different size employees in workstations where the entire work surface is one height.

The use of monitor supports is also an excellent way of adapting existing workstations that are too small, or that have seating that is not adjustable.

Specifications

1. The device should have a matte finish.
2. The device should be able to hold the weight of a terminal approximately 50 lb. - 60 lb. (22.7 - 27.2 kg.) (Color monitors are heavier).
3. The platforms should have a lip to prevent the terminal from slipping off.
4. The device should be adjustable vertically (up/down).

5. The device should be adjustable horizontally (forward/back).
6. The device should be able to swivel (rotate in the horizontal plane).

Monitor Support Evaluation Checksheet

Table A.7 presents the Monitor Support Evaluation Checksheet

Table A.7
Monitor Support Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Yes	Criteria No	N/A
Monitor Support Arm	Adjustability	Monitor support arm should be adjustable both vertically and horizontally.			
	Swivel	Monitor support arm should be able to swivel (rotate in the horizontal plane).			
	Finish	Monitor support arm should have a matte finish.			
		Platform should have a lip to prevent the terminal from slipping off.			
	Weight	Monitor support arm should be able to hold the weight of a terminal approximately 50-60 lb. (22.7 - 27.2 kg.) (Color monitors are heavier)			
Comments: _____					

A.5.2.8 Criteria for Task Lighting. The need for task lighting is determined based on the overall ambient light level, the amount of time the user spends viewing source documents or reference materials, the condition of the documents, and the individual requirements of the users. (Generally, a person 60 years of age requires three times as much light as a person 20 years of age.)

Task lighting is recommended for workstation layouts where ambient light levels are 50 foot-candles (500 lux) or less.

Note: If the form of task lighting that has been provided in existing workstations is the under-shelf type, then it is critical **not** to place the monitor beneath those lights, as diffused glare on the screen is likely.

The free-swinging arm lamp (clamped to the side of the table or hooked onto the paneling) is preferable to the lamp attached underside a shelving unit, because of its flexibility. However, extreme care should be taken to keep the bulb out of the worker's direct line of sight. To control the potential for glare, it is desirable that task lamps be covered with diffusers.

Specifications for Task Lighting

1. The light casing should have a matte finish.
2. The light should be adjustable vertically, horizontally, and should be able to rotate.
3. The bulb should not protrude from the bottom of the light fixture.
4. The light should (ideally) clip onto the work surface or panel.
5. Under-shelf lighting is acceptable; however, the VDT should not be placed directly underneath.

Task Lighting Evaluation Checksheet

Table A.8 is the Task Lighting Checksheet.

Table A.8
Task Lighting Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Task Lighting	Adjustability	Task lighting should be adjustable vertically, horizontally, and should be able to rotate.			
	Finish	Task lighting should have a matte finish.			
	Bulb	The bulb should not protrude from the bottom of the light fixture.			
	Security	Task light should ideally clip onto the work surface or panel.			
Comments: _____					

A.5.2.9 Criteria for Keyboard Design. A number of ergonomic risk factors which have been identified in office work may be associated with to keyboard design and use. Factors such as: repetitive work (keying), forceful exertions, awkward positions of the hand, wrist and arms, direct mechanical pressure and prolonged constrained postures, have been observed in many administrative tasks

In the office environment, the alphanumeric keyboard is used by most data entry and word processing operators. An alphanumeric keyboard is an array of keys organized into functional groups. There are two primary types; the Dvorak and the Qwerty. The Dvorak keyboard layout places most frequently used keys in the English language in the area of the keyboard where the strongest fingers are located during touch keying. The Qwerty name keyboard layout is the traditional design that most typists and computer users are familiar with. The Qwerty is used because the six keys on the second row from the top (left) spell Q-W-E-R-T-Y.

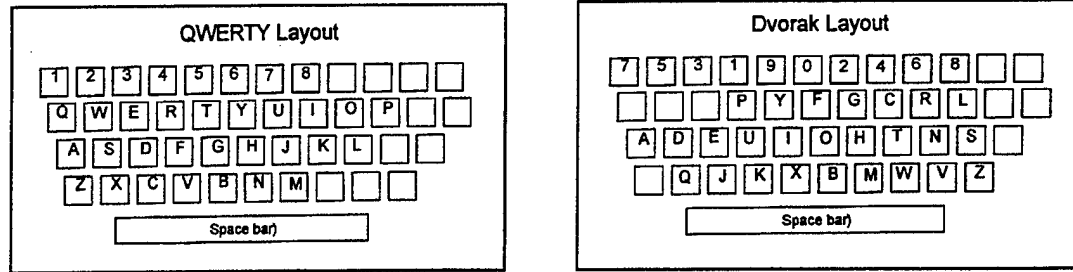


Figure A.19
Keyboard Types - Qwerty and Dvorak Layout

Keyboards can be presented in a number of profiles - positive slope (rises away from the front of the surface), negative slope (falls away from the front of the surface), a dished profile (represents a continuous concave curve) and a flat profile (continuous height throughout key layout).

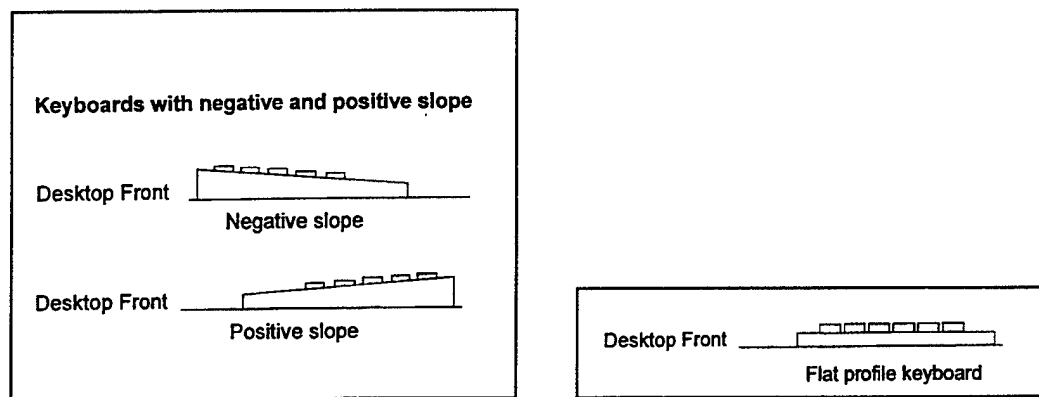


Figure A.19
Keyboard Profiles

The layout and design of the keyboard can affect the performance and the comfort of the user. Recent research has indicated that a negative slope keyboard may provide some benefit to wrist stress reduction. This is only the case, however, when use of the keyboard promoted the neutral position (flat wrist). This may also be achieved without a negative slope design.

Negative vs. Positive Keyboard Slope

The traditional keyboard slope of a Qwerty keyboard is positive. Research suggests that a negative keyboard slope as compared to the positive keyboard slope significantly decreases wrist extension. No significant change was noted between the two keyboard types when measuring ulnar/radial deviation of the wrist or elbow angle. Data suggests

that a height adjustable negative keyboard slope can be used to maintain a neutral wrist position when keyboarding.

Specifications for Keyboards

- **Keyboard Design**

1. The height of the keyboard shall not exceed 1.4 inches (35.6 mm). The preferred height is not greater than 1.2 inches (30.5 mm).
2. The recommended slope is 5 to 12 degrees to the horizontal. The slope should not exceed 15 degrees.
3. Sloped, stepped, dished, sculptured and flat profiles of keyboard rows are acceptable.
4. The keys and visible surface of the keyboard should be a matte finish.
5. Dark characters on a light background are recommended.
6. No sharp edges or corners should be present on the keyboard housing.
7. The keyboard should be detachable, stable and easy to reposition.
8. The keyboard should be adjustable in slope.

- **Key Design**

1. The horizontal and vertical distances between two adjacent keys measured center to center shall be .75 inch (19.1 mm) for the alphanumeric section.
2. The strike surface of the keycaps of alphanumeric keys shall be at least 4.3 inch (109.2 mm.) in area, the width of the strike surface shall be between .47 inch (11.9 mm) and .59 inch (15.0 mm).
3. Key displacement shall be between .05 inch (1.3 mm) and .23 inch (5.8 mm)
4. The keys should provide tactile, auditory and visual feedback.
5. The key top shape should be concave in design.
6. The height of characters indicating alphanumeric keys shall not be less than 1 inch (25.4 mm). When an abbreviation is used the height of the capital letters shall not be less than .08 inch (2.0 mm).

The Dvorak keyboard is sometimes specified for an employee who has been experiencing discomfort in the wrist of hands. This accommodation needs to be considered only after other modifications have been made. If it is specified, adequate training and learning time must be provided since the employee must basically re-teach him or herself how to type with this type of keyboard.

Portable Computers/Laptop Computers

Laptops are often utilized in office and non-office environments due to the ease of portability. Some problems noted with laptops is the fixed height of the screen, small keyboard layout and the restrictive nature of some input devices that have replaced the mouse. Whenever possible, laptop use should be kept to a minimum. Ideally, when working in the office environment the laptop should be connected to a larger PC monitor, mouse and keyboard.

Keyboard Design Evaluation Checksheet

Table A.9
Keyboard Design Evaluation Checksheet

Date:			Evaluator:		
Job:			Type:		
Manufacturer:			Model Number:		
Model Name:			Price:		
Category	Parameter	Measure	Meets Criteria		N/A
			Yes	No	
Keyboard	Height	Height of the keyboard should not exceed 1.4 in. (35.6 mm). The preferred height is not greater than 1.2 in. (30.5 mm).			
	Slope	The recommended slope should be 5 to 12 degrees to the horizontal. The slope should not exceed 15 degrees.			
	Finish	Keys and visible surface of the keyboard should be a matte finish.			
	Characters on Keyboard	Dark characters on a light background should be recommended.			
	Edges	No sharp edges or corners should be present on the keyboard housing.			
	Slope	Keyboard should be adjustable in slope.			
	Distance	Horizontal and vertical distance between two adjacent keys measured center to center should be .75 in (19.1 mm) for the alphanumeric section.			
	Strike surface	Strike surface of the keycaps of alphanumeric keys shall be at least .47 in (11.9 mm) to .59 in (15.0 mm) in width.			
	Key Displacement	Key placement should be between .05 in (1.3 mm) to .24 in (5.8 mm).			
	Key Feedback	Keys should provide tactile, auditory and visual feedback.			
	Shape	Key top shape should be concave in design			
Comments:					

**LEVEL I ERGONOMICS ASSESSMENT
SUMMARY AND RECOMMENDATIONS
SAMPLE**

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LEVEL I ERGONOMICS ASSESSMENT SUMMARY AND RECOMMENDATIONS

Date (YYMMDD)	96-10-14	Workplace Identifier:	
Use this space for mechanical imprint)		Base WPAFB, OH	Organization
		Workplace Contracts	
		Bldg. No./Location	Room/Area
		AFSC/Job Series Contract Specialist	

CRITICAL TASKS IN PRIORITY ORDER						
Task Name	Task Rating	Body Regions and Ratings (Circle one for each region)				
		Shoulder/Neck	Hands/Wrists/Arms	Back/Torso	Legs/Feet	Head/Eyes
1. Writing/Reviewing Documents	High Med	High Med	High Med	High Med	High Med	High Med
2.	High Med	High Med	High Med	High Med	High Med	High Med
3.	High Med	High Med	High Med	High Med	High Med	High Med

OVERALL JOB RATING			
RATING:	High	Medium	
(Circle one)			
PRIORITY BODY REGION:	Shoulder/Neck	Hands/Wrists/Arms	
(Circle one)	Back/Torso	Legs/Feet	Head/Eyes

- Findings are consistent with results from Job Requirements and Physical Demands Survey (PHF): ☐ Yes ☐ No ☒ N/A
Comment: Sample Job - No data previous to Level I Assessment
- Findings are consistent with AF Form 190: ☐ Yes ☐ No ☒ N/A
Comment: Sample Job - no data previous to Level I Assessment

RECOMMENDATIONS FOR FOLLOW-UP	
Modifications and adjustments - Lower the worksurface used for writing (or) - Raise the chair and provide a footrest - Encourage employee to avoid working on "stacks" of contracts on the work surface - Encourage employee to stand up when using hole punch Expected Benefits ☒ Health/Safety (Check all that apply) ☐ Productivity/Quality	Major changes and/or purchases - Relocate air conditioned units or vents - Install a larger worksurface for contract review. Expected Benefits ☐ Health/Safety (Check all that apply) ☐ Productivity/Quality
BEF (Sign) _____	

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APPENDIX 6

Forms

**Level I Ergonomics Assessment Checklist
for Administrative Work Areas**

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Level I Ergonomics Assessment Checklist for Administrative Work Areas	Survey Date (YYMMDD)	Workplace Identifier:	
<i>(use this space for mechanical imprint)</i>	Base	Organization	
	Workplace		
	Bldg. No/Location	Room/Area	
	AFSC/Job Series		
	Job Name:		
BEF Technician: _____ Sign			

Level I Ergonomics Assessment Checklist for Administrative Work Areas

Part I - Work Content (Description of Tasks Performed)

Technician: _____

Date: _____

For this section, work with the employee to obtain a basic description of the types of tasks that make up his/her job. For each Type of Work performed, indicate the approximate work frequency by checking the most appropriate circle.

1. **Routine:** Performed *three or more days per week*.
 - **1-4 hrs.:** The total amount of time per day spent performing the task is 1-4 hrs.
 - **> 4 hrs.:** The total amount of time per day spent performing the task is more than 4 hrs.
 - **< 1 hr.:** The total amount of time per day spent performing the task is less than 1 hr.
2. **Non-routine:** Performed two days a week or less.
3. **Never/NA:** This type of work not performed

WORK CONTENT MATRIX

Task <i>If the employee performs tasks which are not listed, write in the additional task types and indicate the work frequency.</i>	Work Frequency (Check one)				
	Never/NA	Non-Routine	Routine		
			< 1 hr.	1-4 hrs.	> 4 hrs.
1. Using a computer - General/word processing	☐	☐	☐	☐	☐
2. Writing/Reviewing documents	☐	☐	☐	☐	☐
3. Stapling	☐	☐	☐	☐	☐
4. Monitoring (vigilance tasks)	☐	☐	☐	☐	☐
5. Calling (telephone use)	☐	☐	☐	☐	☐
6. Copying	☐	☐	☐	☐	☐
7. Drafting/illustrating (CAD/graphics)	☐	☐	☐	☐	☐
8. Filing/general administrative	☐	☐	☐	☐	☐
9. Lifting	☐	☐	☐	☐	☐
10. Use of calculator/numerical pad	☐	☐	☐	☐	☐
11. Microscope	☐	☐	☐	☐	☐
12.	☐	☐	☐	☐	☐
13.	☐	☐	☐	☐	☐
14.	☐	☐	☐	☐	☐
15.	☐	☐	☐	☐	☐

 = Only complete the checklist for critical tasks which are indicated by the shaded box. [Critical tasks include: Routine tasks and Lifting tasks (regardless of frequency)]

Performance Measures

How is your performance measured? _____

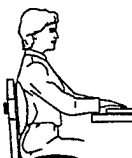
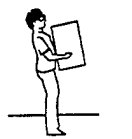
Part II - Shoulder / Neck

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if **BOTH**
 - Task is performed greater than 4 hours per day **AND**
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor **occurs** but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur **OR** is not applicable.

Critical Tasks

	Job Factor	Task	Task	Task	Task	Comments
	1. Upper arms held away from body continuously while unsupported greater than 15° away from the body (e.g., using keyboard, mouse).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	2. Repeated reaching arms greater than 15° away from the body, (e.g., obtaining reference manuals, filing, accessing telephone).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	3. Shrugging working with both shoulders raised while arms unsupported (e.g. keyboard too high).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	4. Repeated arm forces exceeding 10 lb. (4.5 kg.) (roughly equivalent to lifting a gallon of milk), (e.g., pulling files or stapling).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	5. Holding/carrying materials exceeding 25 lb. (11.3 kg.) (e.g., 10" stack of files).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	6. Cradling the telephone between the neck and shoulder	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	7. Head bent down, up, or neck is twisted (e.g., monitor or document too high, too low, off to side).	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)					

Part II - Hands/Wrists/Arms

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if **BOTH**
 - Task is performed greater than 4 hours per day **AND**
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur **OR** is not applicable.

Critical Tasks

	Job Factor	Critical Tasks				Comments
		Task	Task	Task	Task	
	8. Bent Wrists (e.g., any instance when wrist is not straight.)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	9. Repeated Wrist Movements (e.g., manipulating paper)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	10. Repeated Finger Movements (e.g., using keyboard, mouse, paper/equip.)	F=3 S=1 N=0	F=3 S=1 N=0	F=3 S=1 N=0	F=3 S=1 N=0	
	11. Hyperextension of Finger/Thumb. Finger/thumb held away from rest of hand (e.g., using small input devices)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	12. Hand Forces more than minimal force used to key, constant pinch force > 2 lb. (0.9 kg.) (e.g., squeeze staple remover, hitting keys, gripping mouse or pencil, pulling files) constant full-hand force > 5 lb. (2.27 kg.) (e.g., hold gallon of water),	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	13. Hard Edges wrists or forearms rest on hard edges (e.g., desk, keyboard tray, armrests)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	14. Repeated Forearm Rotation (e.g., flipping pages)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)					

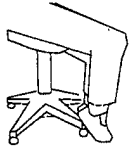
Part II - Back/Torso

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

- **Frequently (F):** if **BOTH**
 - Task is performed greater than 4 hours per day **AND**
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor occurs but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur **OR** is not applicable.

Critical Tasks

	Job Factor	Task	Task	Task	Task	Comments
	15. Leaning Forward or Poor Lower Back Posture (e.g., when sitting, when standing)	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	16. Repeated Bending while standing > 45° forward bending or any observable leaning to the side, twisting or backward bending, (e.g., lifting below knee height)	F=4 S=4 N=0	F=4 S=4 N=0	F=4 S=4 N=0	F=4 S=4 N=0	
	17. Lifting Forces — handling > 50 lb. (22.7 kg.) while close to body or, — handling > 10 lb. (4.5 kg.) While bent and/or reaching (or while seated) or — high speed movements	F=4 S=4 (any duration) N=0	F=4 S=4 (any duration) N=0	F=4 S=4 (any duration) N=0	F=4 S=4 (any duration) N=0	
	18. No Foot Support When sitting, feet cannot rest flat on the floor (e.g., feet dangling, feet tucked back, legs crossed, sitting on leg, etc.)- or foot support not used.	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)					

Part II - Legs/Feet

Job Factors

For Routine Tasks (three or more days/week) or Lifting Tasks for each Job Factor, score:

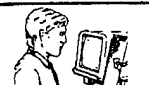
- **Frequently (F):** if **BOTH**
 - Task is performed greater than 4 hours per day **AND**
 - Job Factor occurs greater than 1/2 of task time
- **Sometimes (S):** Job factor **occurs** but does not meet the conditions for a Frequently
- **Never/NA (N):** if the Job Factor does not occur **OR** is not applicable.

Critical Tasks

	Job Factor	Task	Task	Task	Task	Comments
	19. Edge of Seat or worksurface presses into legs.	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	20. Hard Floor Surface Standing and/or walking on hard surfaces.	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	21. Kneeling/Squatting	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	F=4 S=1 N=0	
	Task Scores = (column total)					

Checklist, Head/Eyes

Critical Tasks

	Job Factor	Task	Task	Task	Task	Comments
	22. Staring at Screen or Document	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	23. Glare (e.g., on computer screen, work surface, from overhead lights/windows)	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	24. Light Levels too high or too low	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	25. Screen Distance too far away(>30") (76.2 kg.) or too close(<18") (45.7 kg.)	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	26. Difficult to Read Computer screen/ documents are difficult to read (e.g., text too small, poor display quality)	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	F=2 S=1 N=0	
	Task Scores = (column total)					

Environmental Factors

Environmental Score =

Part IV - Employee Suggestion

Ask the employee for any suggestions for corrective actions that they may have.

[illegible]

CHECKLIST SCORING SUMMARY

Technician _____ Date _____

1. Job Description: Please write out job description.

2. Scoring Summary: Transfer scores from individual scoring sheets.

Body Region	Task Scores				Priority Score by Body Region	Priority Rating by Body Region
	Task Name:	Task Name:	Task Name:	Task Name:	Add across row and divide by # of tasks for average	High: 8+ Med: 4-7 Low: 0-3
<u>Shoulder/Neck</u>					=	High Med Low
<u>Hand/Wrist/Arm</u>					=	High Med Low
<u>Back/Torso</u>					=	High Med Low
<u>Legs/Feet</u>					=	High Med Low
<u>Head/Eyes</u>					=	High Med Low

Select the highest body region score for each task then circle below for High, Med, Low	Highest Score	Highest Score	Highest Score	Highest Score
High: 8+ Med: 4-7 Low: 0-3	High Med Low	High Med Low	High Med Low	High Med Low

Environmental Rating
High Med Low

3. Case Study Selection: Select the case studies that match the high or medium rated tasks that you identified for this job. Place a ✓ in the appropriate boxes below and then turn to the appropriate case study in Appendix 4.

CASE STUDIES		
1. Use of Computer • Keying/Typing • Mousing	5. Calling (Telephone Use)	9. Use of Calculator/ Numeric Keypad
2. Writing/Illustrating	6. Copying/Sorting	10. Lifting/Pushing/Pulling
3. Stapling	7. Drafting (CAD Systems)	11. Microscope Work
4. Monitoring Visual Display (Vigilance)	8. Filing/Administrative	

Overall Job Priority Score	
Highest Avg. Priority Score by Body Region	High Med Low
Body Region	

Corrective Action List (Administrative Work Areas)

Select the corrective action from the case studies pages paying particular attention to the body regions that are primary and secondary concerns. Place a ✓ in the appropriate boxes below as you select from each case study.

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
1. Alternate between sitting and standing			
2. Alternate grips for pen to help reduce gripping force			
3. Angle telephone base slightly			
4. Angle work surface to bring work closer to the body and the eye			
5. Center numeric pad or calculator in front of body			
6. Check eyes and correct for visual disorders			
7. Clean screen regularly			
8. Close blinds or curtains			
9. Cover or turn out under cabinet lighting			
10. Direct task light away from screen and eyes			
11. Group frequently used items together for convenient retrieval			
12. Improve character size and style on document and monitor			
13. Incorporate health comfort strategies • alternate tasks • stretch • take rest pauses			
14. Install adjustable forearm rest			A.5.2.1
15. Install alternative mouse			
16. Install anti-glare screen			
17. Install larger keyboard tray			A.5.2.6
18. Install palm rest			

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
19. Install palm support entire length of drafting table			A.5.2.6
20. Install parabolic louvers to direct light down on the surface			
21. Install push button phone			
22. Investigate use of alternative calculator/keyboard			
23. Kneel to access lower level of photocopier			
24. Kneel to access low level shelves			
25. Locate frequently retrieved items between knee and shoulder height			
26. Locate heavy items between knee and waist level			
27. Locate sorting piles near work surface edge			
28. Lower chair			A.5.1.4
29. Lower items below shoulder height			A.5.1.3
30. Lower keyboard tray or work surface			
31. Lower light levels			A.5.1.5
32. Lower sort shelves below shoulder height			A.5.1.4
33. Move chair closer to surface edge			
34. Move items closer to body			
35. Move items in work zone			
36. Move keyboard forward so forearms rest evenly on surface			
37. Move microscope closer to edge			

Corrective Action List (Administrative Work Areas) Cont'd

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
38. Move microscope forward so forearms rest evenly on surface			
39. Move monitor from underneath shelves			
40. Move monitor out from under cabinet lighting			
41. Move mouse/keyboard forward so forearms rest evenly on surface			
42. Move stapler closer to work surface edge			
43. Move telephone in work zone			
44. Orient paper by turning it so that area worked in is close to the body			
45. Periodically look away from microscope to change the task demand on the eye and focus on an object of varying distance			
46. Periodically look away from screen.			
47. Place binders on work surface			
48. Place hand when not dialing on worksurface or lap.			
49. Place keyboard and mouse on work surface			
50. Place keyboard/calculator /monitor onto larger surface			
51. Place microscope on larger surface			
52. Place monitor on alternative work surface			
53. Place monitor perpendicular to window			
54. Position body closer to work			

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
55. Position desk perpendicular to the window			
56. Position document at a comfortable viewing distance for larger blue prints by folding document or loosely rolling			
57. Position document on document support same height and angle as monitor. If document is handled, flipped or written on, a slightly inclined surface is preferred. Place document on side of dominant eye.			
58. Position monitor 18 - 30 " (45.7- 76.2 cm.)from eyes			
59. Position monitor appropriately. -For drawing work, so that eye level is at mid-screen . - For non-drawing tasks, the primary work area on the screen should be just below eye level. - For bifocal user, so that the neck is upright, not tilted (usually directly on the work surface) • place on monitor blocks • place monitor on hard drive • place monitor on work surface			
60. Position monitor between overhead lights			
61. Position monitor in front of body			
62. Position monitor so eyes are mid level on screen			
63. Position mouse next to keyboard			
64. Position mouse			

Corrective Action List (Administrative Work Areas) Cont'd

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
next to keyboard at same height			
65. Position numeric pad in front of monitor			
66. Position tablet in primary zone			A.5.2.2
67. Program macro keys to reduce keying			
68. Properly maintain carts			
69. Provide additional staff			
70. Provide adequate storage			A.5.2.3
71. Provide alternative work surface layout			A.5.2.2
72. Provide anti-fatigue mats			
73. Provide appropriate cart			
74. Provide appropriate document holder			A.5.2.5
75. Provide back support			
76. Provide footrest			A.5.2.4
77. Provide larger work surface			A.5.2.2
78. Provide proper chair			A.5.2.1
79. Provide screen hood/visor			
80. Provide standing workstation			
81. Provide stapler with longer, level arm			
82. Provide task light			A.5.2.8
83. Provide telephone headset			
84. Raise arm rest(s)			A.5.1.4
85. Raise chair			A.5.1.4
86. Raise desk with 1 - 2 "blocks"			
87. Raise keyboard or work surface			A.5.1.3
88. Redesign job			
89. Remove clutter from under work surface			

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
90. Remove or lower armrests			A.5.1.4
91. Rotate staff members between tasks			
92. Stand up and reach for items positioned above desk or in reference zone.			
93. Tilt monitor down so it is parallel to floor			A.5.1.5
94. Train worker to properly adjust chair			
95. Train proper body mechanics/posture			
96. Train proper keying style			
97. Train proper microscope technique			
98. Train proper mousing style			
99. Train use of available footrest			
100. Use a flat staple remover with a power grip rather than a pinch grip			
101. Use an available telephone headset			
102. Use automatic stapler			
103. Use available alternative work surface			
104. Use available cart to move boxes, files etc.			
105. Use available chair with adjustable armrest(s) for forearm support			A.5.1.4
106. Use height adjustable armrests to support the forearm			A.5.1.4
107. Use keyboard tray that accommodates mouse, keyboard and palm support			
108. Use larger stapler with longer level			

Corrective Action List (Administrative Work Areas) Cont'd

Job Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
arms			
109. Use proper cart to move files			
110. Use proper footwear			
111. Use step stool to access high level shelves			
112. Use task specific lens			
113. Use well-fitting gripper gloves to pull files			

Environmental Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
1. Close doors when possible to reduce noise			
2. Complete a space plan			
3. Eliminate/reduce loud radios, p.a. announcements and phone signals (ringers)			
4. Install accoustical panels			
5. Install printer covers to isolate noise			
6. Install separate air conditioning units when possible			
7. Install wall panel(s)			
8. Minimize clutter on desk/worksurfaces			

Environmental Factors

Corrective Action	Action Selected		Implementation Reference (Appendix 5)
	Minor	Major	
9. Open doors/windows when possible			
10. Provide adequate storage			
11. Provide portable fan(s)			
12. Provide portable heater(s)			
13. Rearrange desk/worksurfaces			
14. Rearrange workarea to avoid face-to-face workstations			
15. Redesign work areas			
16. Redirect air conditioning units and/or fans			
17. Relocate workstation away from air vents			
18. Remove unnecessary boxes from workareas and/or walkways			
19. Use airconditioning when provided			
20. Use heavier clothing when possible			
21. Use lighter clothing when possible			
22. Vent portable air conditioners and other heat producing equipment to outdoors when possible			

LEVEL I ERGONOMICS ASSESSMENT SUMMARY AND RECOMMENDATIONS

Date (YYMMDD)		Workplace Identifier:	
Use this space for mechanical imprint		Base	Organization
		Workplace	
		Bldg. No./Location	Room/Area
		AFSC/Job Series	

CRITICAL TASKS IN PRIORITY ORDER

Task Name	Task Rating	Body Regions and Ratings (Circle one for each region)				
		Shoulder/Neck	Hands/Wrists/ Arms	Back/Torso	Legs/Feet	Head/Eyes
1.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med
2.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med
3.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med
4.	High	High	High	High	High	High
	Med	Med	Med	Med	Med	Med

OVERALL JOB RATING

RATING: High Medium (Circle one)	PRIORITY BODY REGION: _____ (Write in)

- Findings are consistent with results from Job Requirements and Physical Demands Survey (PHF): ☐ Yes ☐ No ☐ N/A
 Comment: _____

- Findings are consistent with AF Form 190: ☐ Yes ☐ No ☐ N/A
 Comment: _____

RECOMMENDATIONS FOR FOLLOW-UP

Modifications and adjustments Expected Benefits (Check all that apply) ☐ Health/Safety ☐ Productivity/Quality 	Major changes and/or purchases Expected Benefits (Check all that apply) ☐ Health/Safety ☐ Productivity/Quality

BEF (Sign) _____

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APPENDIX 7

References \Bibliography

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REFERENCES

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REFERENCES

1. Starr, J. Steven. Effects of Video Display Terminals in a Business Office. (1984) *Human Factors* (Vol 3. No. 356. p.354).
2. Howarth, Peter Alan, and Instance, Owen (1985). The Association Between Visual Discomfort and the Use of Visual Display Units, *Behavior and Information Technology* (Vol. 4, No. 2, pp 131-149) .
3. Levy, Finn and Ramberg, Ingrid. (1986) Eye Fatigue among VDU users and Non-VDU users. In *Proceedings of the International Scientific Conference: Work With Video Display Units.*(pp. 42-52) Swedish National Board of Occupational Safety and Health Research Department.
4. Chaffin, D.B., and Andersson, G.B.J., (1984). *Occupational Biomechanics*. New York: John Wiley & Sons. (pp. 336 - 341).
5. Grandjean, Etienne, (1988). *Fitting the Task to the Man: A Textbook of Occupational Ergonomics*. Taylor & Francis Ltd., London. pp. 36 - 81.
6. Putz-Anderson, V., (1992). Cumulative Trauma Disorders: *A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London. (pp 52).
7. Snook , S.H., Ciriello, V.M., (1991). "The Design of Manual Materials Handling Tasks: Revised Tables of Maximum Acceptable Weights and Forces." *Ergonomics* (Vol. 34, No. 9., pp. 1210).
8. Dale, W.A., (1982). "Outlet Compression Syndrome." *Archives of Surgery* (Vol. 117, pp. 1437-1445).
9. Tyson, R.R., and Kaplan, G.F., (1975). "Modern Concepts of Diagnosis and Treatment of Thoracic Outlet Syndrome." *Orthop. Clinics of North America* (Vol. 6, pp. 507 - 519).
10. Stetson, D.D., Keyserling, W.M., Silverstein, B.A., and Leonard, J.A., (November 1991). "Observational Analysis of the Hand and Wrist: A Pilot Study." *Applied Occupational and Environmental Hygiene*. DOL & State of Washington (Vol. 6, No. 11, pp. 927 - 937).
11. Goldstein, S.A., Armstrong, T.J., Chaffin, D.B., Matthews, L.S., (1987). "Analysis of Cumulative Strain in Tendons and Tendon Sheaths." *Journal of Biomechanics* (20 (1), pp. 1-6).

12. American National Standards Institute (ANSI) Draft Standard Z-365, (June 1993).
Control of Trauma Disorders (pp. 6-4).
13. OSHA Draft Ergonomic Protection Standard (listed as a risk factor in OSHA's
Workplace Risk Factor Checklist).
14. Van Wely, P., (1970). "Design and Disease." *Applied Ergonomics* (Vol. 1, pp. 262
- 269).
15. NIOSH, Applications Manual for the Revised NIOSH Lifting Equation. (1994) U.S.
Department of Health and Human Services.
16. Kumar, S., (1995). "Development of Predictive Equations for Lifting Strength,"
Applied Ergonomics (Vol. 26, No. 5, pp. 327 - 341).
17. Fard, H. Mital, A., (1993). "A Psychophysical Study of High and Very High
Frequency Manual Materials Handling--Part I: Lifting and Lowering,"
International Journal of Industrial Ergonomics (Vol. 12, pp. 127 - 141, 143 -
156).
18. Konz, S., (1994). *Ergonomics* (Vol. 37, No. 4, pp. 677).
19. Ryan, G.A., (1989). "Musculoskeletal Symptoms in Supermarket Workers,"
Ergonomics (Vol. 32, No. 4, pp. 359 - 371).
20. Bergqvist, U., (1995). "Video Display Terminal Work--A Perspective on Long-
Term Changes." *International Journal of Industrial Ergonomics* (Vol. 16, pp.
201 - 209).
21. Canadian Standards Association, (1989). *Office Ergonomics: A National Standard
of Canada*. (pp. 54 - 56).
22. American National Standards Institute (ANSI)/Human Factors Society Standard
100, (1988). *Human Factors Engineering of Visual Display Terminal
Workstations*. (p.11).
23. AFOSH STD 48-19, Chapter 2.
24. USAF Technical Report on Indoor Air Quality, (pp. 24).
25. McAtamney, L., and Corlett, E.N., (1993). RULA - A Survey Method for the
Investigation of Work Related Upper Limb Disorders. *Applied Ergonomics*
(Vol. 24, No. 2, pp. 92).

26. Kemmlert, K., (1994). A Method Assigned for the Identification of Ergonomic Hazards - PLIBEL. *Scandinavian Journal of Rehabilitation Medicine* (Vol. 26, pp. 1-21).
27. Keyserling, W.M., Stetson, D.S., Silverstein, B.A., and Brouwer, M.L. (1993) A checklist for evaluation ergonomic risk factors associated with upper extremity cumulative trauma disorders. *Ergonomics* (Vol. 36, No. 7, P. 811).
28. Punnett, L., Robins, J.M., Wegnan, D.H. and Keyserling, M., (1985). "Soft Tissue Disorders In The Upper Limbs Of Female Garment Workers", *Scandinavian Journal of Work and Environmental Health* (pp. 417-425) as cited in Sommerich, C.M., McGlothlin, J. D., Marras., W. S., (1993). "Occupational risk factors associated with soft tissue disorders of the shoulder: a review of recent investigations in the literature". *Ergonomics* (Vol. 36, No. 6, pp. 697-717).
29. Kilbom, A., Persson. J., (1988). "Work Technique and its Consequences for Musculoskeletal Disorder". *Ergonomics* (Vol. 31, No. 5, pp. 276). Research Department of the Swedish National Board of Occupational Safety and Health, S-17184, Solna, Sweden.
30. Herberts, P., Kadefors, R., Hagfors, C. and Sigholm, G., (1984). "Shoulder Pain and Heavy Manual Labor, *Clinical Orthopaedics and Related Research* (pp. 166-178), as cited in Sommerich, C.M., McGlothlin, J. D., Marras., W. S., (1993). "Occupational Risk Factors Associated With Soft Tissue Disorders of the Shoulder: a Review of Recent Investigations in the Literature". *Ergonomics* (Vol. 36, No 6, pp. 697-717).
31. Van Cott, H.P., and Kincade, R.G., (1972). *Human Engineering Guide to Equipment Design*. (pp. 72). Washington D.C., U.S. Government Printing Office.
32. Wells, J.A., Zipp, J.F., Schuetter, P.T. and McEleney, J., (1983). "Musculoskeletal Disorders Among Letter Carriers". *Journal of Occupational Medicine* (pp. 814-820), as cited in Sommerich, C.M., McGlothlin, J. D., Marras., W. S. , (1993). "Occupational Risk Factors Associated With Soft Tissue Disorders of the Shoulder: A Review of Recent Investigations in the Literature". *Ergonomics* (Vol. 36, No. 6, pp. 697-717).
33. McGehen, F.P., (1977). "When Is a Product Portable?". *Dimensions/NBS*. Washington, D.C.: National Bureau of Standards (pp. 16-19), as cited in *Ergonomic Design for People at Work* (1986). (Vol 2., pp. 420). Eastman Kodak Company.

34. Chaffin, D.B. (1973). Localized Muscle Fatigue: Definition and Measurement. *Journal of Occupational Medicine* (Vol. 15, pp. 346-354).
35. Chaffin, D.B., and Andersson, G.B.J. (1984). *Occupational Biomechanics*. New York: John Wiley & Sons. (pp. 347).
36. Kilbom, A., Persson, J. and Jonsson, B.G., (1986). "Disorders of the Cervicobrochial Region Among Female Workers in the Electronics Industry. *International Journal of Industrial Ergonomics* (Vol 1., pp. 37-47).
37. Putz-Anderson, V., (1992). Cumulative Trauma Disorders: *A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London. (pp. 23).
38. Silverstein, B.A., Fine, L.J., and Armstrong, T.J. (1987). Occupational Factors and Carpal Tunnel Syndrome. *American Journal of Industrial Medicine* (Vol. 11, pp. 343-358).
39. Hammer, A.W., (1934). *International Record of Medicine (Medical Record)* (pp. 139-140).
40. Putz-Anderson, V., (1992). Cumulative Trauma Disorders: *A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London. (pp. 66).
41. Keyserling, W.M., Stetson, D.S., Silverstein, B.A., and Brouwer, M.L., (1993). A Checklist for Evaluation Ergonomic Risk Factors Associated with Upper Extremity Cumulative Trauma Disorders. *Ergonomics* (Vol. 36, No. 7, pp. 810).
42. Putz-Anderson, V., (1992). Cumulative Trauma Disorders: *A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London (pp. 68-69).
43. Keyserling, W.M., (1986) "A Computer-Aided System to Evaluate Postural Stress in the Workplace". *AIHA Journal* (Vol 47. pp. 641-649)
44. Mattila, M., Karwowski, W., and Vilkkio, M. (1993, December). Analysis of Working Postures in Hammering Tasks on Building Construction Sites Using the Computerized OWAS Method. *Applied Ergonomics* (Vol. 24, No. 6).
45. Canadian Standards Association, *Office Ergonomics: A National Standard of Canada*, 1989, pp. 27-29.

46. American National Standards Institute (ANSI)/Human Factors Society Standard 100, (1988). *Human Factors Engineering of Visual Display Terminal Workstations* (pp. 17-31).
47. Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 63).
48. American National Standards Institute (ANSI)/Human Factors Society Standard 100, (1988). *Human Factors Engineering of Visual Display Terminal Workstations* (pp. 14).
49. Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 69).
50. Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 72-75).
51. Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 80).
52. Graf, M., Guggenbuhl U., Krueger, H., (1995). "An Assessment of Seated Activity and Postures at Five Workplaces". *International Journal of Industrial Ergonomics*. (Vol. 15 pp. 81-90).

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BIBLIOGRAPHY

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BIBLIOGRAPHY

- Abu-Ali, M., Purswell, J.L., and Schlegel, R.E. (1994, September). Psychophysically Determined Work-Cycle Parameters for Repetitive Hand Gripping. *International Journal of Industrial Ergonomics*.
- Adams, M., Franklin, G., and Barnhart, S. (1994). Outcome of Carpal Tunnel Surgery in Washington State Workers' Compensation. *American Journal of Industrial Medicine* (Vol. 25, pp. 527-536).
- AFI 48-101. Aerospace Medical Operations.
- AFI 91-301. Air Force Occupational & Environmental.
- AFOSH STD 127-31. Personal Protective Equipment.
- AFOSH STD 161-17. Standardized Occupational Health Program.
- AFOSH STD 48-1. Respiratory Protection Program.
- AFOSH STD 48-17. Integrated Occupational Health Program.
- AFOSH STD 48-3 (Draft). Ergonomics Program.
- AFOSH STD 91-204. Investigating & Reporting US Air Force Mishaps.
- AFOSH STD 48-19, Chapter 2.
- Aghazadeh, F., Bisesi, M.S., Rivas, R.D. (1995). Comfort of Personal Protective Equipment. *Applied Ergonomics*, (Vol. 26, No. 3, pp. 195-198).
- American National Standards Institute (ANSI) Draft Standard Z-365, (June 1993). *Control of Trauma Disorders* (pp. 6-4).
- American National Standards Institute (ANSI) National Safety Council Draft Standard Z-365, (1995, April 17). *Control of Work Related Cumulative Trauma Disorders*. Working draft.
- American National Standards Institute (ANSI) National Safety Council Draft Standard Z-365, (1992, June 11). *Control of Cumulative Trauma Disorders*. Draft Outline.
- American National Standards Institute (ANSI)/Human Factors Society Standard 100, (1988). *Human Factors Engineering of Visual Display Terminal Workstations*. (p.11).

- American National Standards Institute (ANSI)/Human Factors Society Standard 100, (1988). *Human Factors Engineering of Visual Display Terminal Workstations* (pp. 17-31).
- American National Standards Institute (ANSI)/Human Factors Society Standard 100, (1988). *Human Factors Engineering of Visual Display Terminal Workstations* (pp. 14).
- American National Standards Institute (ANSI)/Human Factors Society Standard 100 (1988). *Human Factors Engineering of Visual Display Terminal Workstation*.
- Appendix 23-A. (1992. November 2). *Checklist for Evaluation of Ergonomic Stress in Industrial Shops*.
- Appendix 23-B. *Checklist for Evaluation of Ergonomic Stress at Workstations Equipped with Video Display Terminals*.
- Appendix A. (1993, June 4). *Sample Surveillance Tools*.
- Appendix B. *Controlling Workplace Risk Factors*.
- Application of Survival Analysis to CTD Risk Assessment. (1992). In *Proceedings of the Human Factors Society 36th Annual Meeting*.
- Armstrong, T., Werner, R., Waring, W., and Foulke, J. (1986). *Intra-Carpal Canal Pressure in Selected Hand Tasks*. The University of Michigan.
- Bartko, J. J. and Carpenter, W. T. (1976). On the Methods and Theory of Reliability. *The Journal of Nervous and Mental Disease* (Vol. 163, No. 5, pp. 307-317).
- Bateman, J.E. (1983). Neurologic Painful Conditions Affecting the Shoulder. *Clinical Orthopaedics and Related Research* (Vol. 173, pp. 44-54).
- Batra, S., Wang, M.J., and Bishu, R.R. (1994). Glove attributes: Can They Predict Performance? *International Journal of Industrial Ergonomics* (Vol. 14, pp. 201-209).
- Bergqvist, M.G., Almby, B., Jansson, E.S. (1994). Hand and Shoulder Ailments Among Laboratory Technicians Using Modern Plunger-Operated Pipettes. *Applied Ergonomics* (Vol. 25, No. 2, pp. 88)
- Bergqvist, U. (1995). Video Display Terminal Work - A Perspective on Long Term Changes. *International Journal of Industrial Ergonomics*. (Vol. 16, pp. 201-209).

- Bigos, S., Battie, M., Spengler, D., Fisher, L., Fordyce, W., Hansson, T., Nachemson, A., and Wortley, M. (1991). A Prospective Study of Work Perceptions and Psychosocial Factors Affecting the Report of Back Injury. *Spine* (Vol. 16, No. 1, pp. 1-6).
- Bishu, R.R., and Klute, G. (1995). The Effects of External Vehicular Activity (EVA) Gloves on Human Performance. *International Journal of Industrial Ergonomics* (Vol. 16, pp. 165-174).
- Bjelle, A., Hagberg, M. and Michaelsson, G. (1979). Clinical and Ergonomic Factors in Prolonged Shoulder Pain Among Industrial Workers. *Scandinavian Journal of Work, Environment & Health* (Vol. 5, pp. 205-210).
- Bond, G.G., Bodner, K.M., Sobel, W. Shellenberger, R.J. and Flores, G.H. (1988). Validation of Work Histories Obtained from Interviews. *American Journal of Epidemiology* (Vol. 128, No. 2, pp. 343-351).
- Borg, G. (1970). Perceived Exertion as an Indicator of Somatic Stress. *Scandinavian Journal of Rehabilitation Medicine* (Vol. 2, pp. 92-98).
- Buckle, P. (1994). Measurement of Exposure Variables in Research Relating to Musculoskeletal Disorders, with Specific Reference to Work with Display Units. University of Surrey.
- Burdorf, A. (1992). Exposure Assessment of Risk Factors for Disorders of the Back in Occupational Epidemiology. *Scandinavian Journal of Work, Environment & Health* (Vol. 18, pp. 1-9).
- Cakir, A., Hart, D.J., and Stewart, T.F.M. *Visual Display Terminals: A Manual Covering Ergonomics Workplace Design, Health and Safety, Task Organization*. Chichester: John Wiley & Sons.
- Canadian Standards Association (1989). *Office Ergonomics: A National Standard of Canada* (pp. 56). (CAN/CSA-Z412-M89). Canadian Standards Association., Rexdale, Ontario.
- Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 63).
- Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 69).
- Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 72-75).
- Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada* (pp. 80).

- Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada*, , (p. 27-29.)
- Canadian Standards Association, (1989). *Office Ergonomics: A National Standard of Canada*. (pp. 54 - 56).
- Carayon, P., and Smith, M. Work Organization Factors and Upper Limb Musculoskeletal Disorders in Offices. University of Wisconsin, Madison.
- Carrasco, C., Coleman, N., and Healey, S. (1995). Packaging Products for Customers: An Ergonomics Evaluation of Three Supermarket Checkouts. *Applied Ergonomics* (Vol. 26, No. 2, pp. 101).
- Chaffin, D. B., Park, K. S. (1973). "A Longitudinal Study of Low-Back Pain as Associated with Occupational Weight Lifting Factors". *American Industrial Hygiene Association Journal*, pp. 513-525.
- Chaffin, D.B. (1973). Localized Muscle Fatigue: Definition and Measurement. *Journal of Occupational Medicine* (Vol. 15, pp. 346-354).
- Chaffin, D.B., and Andersson, G.B.J. (1984). *Occupational Biomechanics*. New York: John Wiley & Sons.
- Cheadle, A., Franklin, G., Wolfhagen, C., Savarino, J., Liu, P., Salley, C., and Weaver, M. (1994, February). Factors Influencing the Duration of Work-Related Disability: A Population-Based Study of Washington State Workers' Compensation. *American Journal of Public Health* (Vol. 84, No. 2).
- Cohen, J. (1960). A Coefficient of Agreement for Nominal Scales. *Educational and Psychological Measurement* (Vol. 20, pp. 37 - 46).
- Cole, L and Rosa, R. (1994). Construction and Validation of a Musculoskeletal Risk Questionnaire . In *Proceedings of the Human Factors and Ergonomics Society 38th Annual* (pp. 984).
- Cole, L. L. (1995, November 20). *Construction and Validation of a Musculoskeletal Risk Questionnaire*. Dissertation.
- Colombini, D., Occhipinti, E., Molteni, G., Semeraro, D., and Grieco, A. (1992, September). A Study of Muscle Activity in Workplaces with Keyboard Operations. *Abstract Book from Third International Scientific Conference on Work with Display Units*.
- Corlett, E.N. (1983). Analysis and Evaluation of Working Postures. In T.O. Kvalseth (Ed.). *Ergonomics of Workstation Design* (pp. 12-15). London: Butterworths.

- Council of the European Communities (1990, May). Council Directive 90/270/EEC of Article 16 (1) of Council Directive 89/391/EEC.
- Dale, W.A. (1982). Thoracic Outlet Compression Syndrome. *Archives of Surgery* (Vol. 117, pp. 1437-1445).
- Delisie, A., Gagnon, M. (1995, July). Segmental Dynamic Analysis When Throwing Loads. *International Journal of Industrial Ergonomics* (Vol. 16, No. 1, pp. 9-21).
- Dempsey, P.G., and Ayoub, M.M. (1996). The Influence of Gender, Grasp Type, Pinch Width and Wrist Position on Sustained Pinch Strength. *International Journal of Industrial Ergonomics* (Vol. 17, pp. 259-273).
- Dickinson, C.E., Campion, K., Foster, A.F., Newman, S.J., O'Rourke, A.M.T., and Thomas, P.G. (1992, June). Questionnaire Development: An Examination of the Nordic Musculoskeletal Questionnaire. *Applied Ergonomics* (Vol. 23, No. 3, pp. 197-201).
- Drury, C.G. (1990). Methods for Direct Observation of Performance, in Wilson, J.R., Corlett, and E.N., (eds.). *Evaluation of Human Work* (pp. 35-57). London: Taylor and Francis.
- Dunbar, E. (1993). The Role of Psychological Stress and Prior Experience in the Use of Personal Protective Equipment. *Journal of Safety Research* (Vol. 24, No. 3, pp. 181-187).
- Engkvist, I, Hagberg, M., Wigaeus-Hjelm, E., Menckel, E., Ekenvall, L., and PROSA Study Group. (1995) Interview Protocols and Ergonomics Checklist for Analyzing (sic) Overexertion Back Accidents Among Nursing Personnel. *Applied Ergonomics*. (Vol. 26, no 3, pp. 213-220).
- Fard, H., and Mital, A. (1993). A Psychophysical Study of High and Very High Frequency Manual Materials Handling - Part I: Lifting and Lowering. *International Journal of Industrial Ergonomics* (Vol. 12, pp. 127-141).
- Fard, H., and Mital, A. (1993). A Psychophysical Study of High and Very High Frequency Manual Materials Handling - Part II: Carrying and Turning. *International Journal of Industrial Ergonomics* (Vol. 12, pp. 143-156).
- Feldman, R.G., Goldman, R., and Keyserling, W.M. (1983). Peripheral Nerve Entrapment Syndromes and Ergonomic Factors. *American Journal of Industrial Medicine* (Vol. 4, pp. 661-681).

- Fleiss, J. L. and Cohen, J., The Equivalence of Weighted Kappa and the Intraclass Correlation Coefficient as Measures of Reliability. *Educational and Psychological Measurement* (Vol. 33, pp. 613 to 619).
- Garg, A., and Moore, J.S. (1993). A Job Analysis Method for Predicting Risk of Upper Extremity Disorders at work: Preliminary Results, in R. Nielsen and K. Jorgensen, (eds.). *Advances in Industrial Ergonomics and Safety* (pp. 163-169). Taylor and Francis.
- Garg, A., Owen, B. (1994). Prevention of Back Injuries in Health Care Workers. *International Journal of Industrial Ergonomics* (Vol. 14, pp. 315-331).
- Goldstein, S.A., Armstrong, T.J., Chaffin, D.B., Matthews, L.S., (1987). "Analysis of Cumulative Strain in Tendons and Tendon Sheaths." *Journal of Biomechanics* (20 (1), pp. 1-6).
- Graf, M., Guggenbuhl U., Krueger, H., (1995). "An Assessment of Seated Activity and Postures at Five Workplaces". *International Journal of Industrial Ergonomics*. (Vol. 15 pp. 81-90).
- Grandjean, E. *Fitting the Task to the Man: A Textbook of Occupational Ergonomics*. (4th Edition, Chapter 1). Taylor & Francis, Ltd.
- Grandjean, Etienne, (1988). *Fitting the Task to the Man: A Textbook of Occupational Ergonomics*. Taylor & Francis Ltd., London. pp. 36 - 81.
- Grant, K.A., Habes, D.J., and Baron, S.L. (1994). An Ergonomics Evaluation of Cashier Work Activities at Check-Unload Workstations. *Applied Ergonomics* (Vol. 25, No. 5, pp. 310).
- Hagberg, M. (1984). Occupational Musculoskeletal Stress and Disorders of the Neck and Shoulder: A Review of Possible Pathophysiology. *International Archives of Occupational and Environmental Health* (Vol. 53, pp. 269-278).
- Haigh, R. (1993). The Aging Process: A Challenge for Design. *Applied Ergonomics* (Vol. 24, No. 1, pp. 9).
- Hammer, A. W. (1934). "Tenosynovitis", *International Record of Medicine*. (pp. 139-140). Taubman Medical, 610.5 M5 J86 R4.
- Hammer, A.W., (1934). *International Record of Medicine (Medical Record)* (pp. 139-140).

- Harber, P., Bloswick, D., Beck, J., Pena, L., Baker, D., and Lee, J. (1993, August). Supermarket Checker Motions and Cumulative Trauma Risk. *Journal of Occupational Medicine* (Vol. 35, No. 8).
- Harber, P., Bloswick, D., Beck, J., Pena, L., Baker, D., and Lee, J. (1992, May). The Ergonomic Challenge of Repetitive Motion with Varying Ergonomic Stresses. *Journal of Occupational Medicine* (Vol. 34, No. 5).
- Hedge, A., Powers, J., and Martin, M. (1992, September). Healthy Keyboarding: An Experimental Test of a Negative Keyboard Slope to Minimize Carpal Tunnel Syndrome Risks. *Abstract Book from Third International Scientific Conference on Work with Display Units*.
- Herberts, P., Kadefors, R., Hagfors, C. and Sigholm, G., (1984). "Shoulder Pain and Heavy Manual Labor, *Clinical Orthopaedics and Related Research* (pp. 166-178), as cited in Sommerich, C.M., McGlothlin, J. D., Marras., W. S., (1993). "Occupational Risk Factors Associated With Soft Tissue Disorders of the Shoulder: A Review of Recent Investigations in the Literature". *Ergonomics* (Vol. 36, No 6, pp. 697-717).
- Heus, R., Daanen, H.A.M., and Havenh, G. (1995). Physiological Criteria for Functioning of Hands in the Cold. *Applied Ergonomics* (Vol. 26, No. 1, pp. 5-13).
- Holmer, I. (1994). Cold Stress - Part I: Guide for the Practitioner. *International Journal of Industrial Ergonomics* (Vol. 14, pp. 139-149).
- Howarth, Peter Alan, and Instance, Owen (1985). The Association Between Visual Discomfort and the Use of Visual Display Units, *Behavior and Information Technology* (Vol. 4, No. 2, pp. 131-149) .
- Hubbell, M.P. A Method to Maximize the Effects of Limited Resources to Reduce the Risk of VDT-Related Musculoskeletal Stress at Sites with 1000's of VDT Stations. McDonnell Douglas Aerospace.
- Joyce, Marilyn S., and Wallersteiner, U. (1989). *Ergonomics: Humanizing the Automated Office*. South-Western Publishing Co., Cincinnati, OH.
- Joyce, Marilyn. (1995). *The Ergonomic Perspective on Psychosocial Issues*. The Joyce Institute, Seattle, WA.
- Katz, J., Punnett, L., Simmons, B., Fossel, A., Mooney, N., and Keller, R. (1996, Jan.). Workers' Compensation Recipients with Carpal Tunnel Syndrome. The Validity of Self-Reported Health Measures. *American Journal of Public Health* (Vol. 86, No. 1, pp. 52-56)

- Kelly, J. P., Rosenberg, L., Kaufman, D. W. and Shapiro, S. (1990). Reliability of Personal Interview Data in a Hospital-Based Case-Control Study. *American Journal of Epidemiology* . (Vol. 31, No. 1, pp. 79-90).
- Kemmlert, K. (1994). A Method Assigned for the Identification of Ergonomic Hazards - PLIBEL. *Scandinavian Journal of Rehabilitation Medicine* (Vol. 26, pp. 1-21).
- Kemmlert, K., (1994). A Method Assigned for the Identification of Ergonomic Hazards - PLIBEL. *Scandinavian Journal of Rehabilitation Medicine* (Vol. 26, pp. 1-21).
- Keyserling, W.M., (1986) "A Computer-Aided System to Evaluate Postural Stress in the Workplace". *AIHA Journal* (Vol. 47. pp. 641-649)
- Keyserling, W.M., Brouwer, M., and Silverstein, B.A. (1993). The Effectiveness of a Joint Labor-Management Program in Controlling Awkward Postures of the Trunk, Neck and Shoulders: Results from a Field Study. *International Journal of Industrial Ergonomics* (Vol. 11, pp. 51-65).
- Keyserling, W.M., Stetson, D.S., Silverstein, B.A., and Brouwer, M.L. (1993) A Checklist for Evaluation Ergonomic Risk Factors Associated with Upper Extremity Cumulative Trauma Disorders. *Ergonomics* (Vol. 36, No. 7, P. 810-811).
- Keyserling, W.M., Stetson, D.S., Silverstein, B.A., and Brouwer, M.L. (1993) A Checklist for Evaluation Ergonomic Risk Factors Associated with Upper Extremity Cumulative Trauma Disorders. *Ergonomics* (Vol. 36, No. 7, pp. 807-831).
- Kihlberg, S. (1995). Biodynamic Response of the Hand-Arm System to Vibration from an Impact Hammer and Grinder. *International Journal of Industrial Ergonomics* (Vol. 16, pp. 1-8).
- Kihlberg, S., Kjellberg, A., and Lindbeck, L. (1995). Discomfort from Pneumatic Tool Torque Reaction: Acceptability Limits. *International Journal of Industrial Ergonomics*.
- Kilbom, A. (1994). Quantification of Physical Exposure. Institute of Occupational Health, S-17184. *International Journal of Industrial Ergonomics* (Vol. 14, pp. 59-86).
- Kilbom, A. (1988). "Intervention Programmes for Work-Related Neck and Upper Limb Disorders: Strategies and Evaluation". *Ergonomics* (Vol. 31, No. 5)
- Kilbom, A., Persson, J. (1988). "Work Technique and its Consequences for Musculoskeletal Disorders", *Ergonomics* (Vol. 31, No. 5)

- Kilbom, A., Persson, J. and Jonsson, B.G., (1986). "Disorders of the Cervicobrochial Region Among Female Workers in the Electronics Industry. *International Journal of Industrial Ergonomics* (Vol. 1., pp. 37-47).
- Kilbom, A., Persson, J., (1988). "Work Technique and its Consequences for Musculoskeletal Disorder". *Ergonomics* (Vol. 31, No. 5, pp. 276). Research Department of the Swedish National Board of Occupational Safety and Health, S-17184, Solna, Sweden.
- Kirwan, B. and Ainsworth, L.K. (1992). *A Guide to Task Analysis*. London: Taylor and Francis.
- Kjellberg, A., and Landstrom, U. (1994). Noise in the Office: Part I - Guidelines for the Practitioner. *International Journal of Industrial Ergonomics* (Vol. 14, pp. 87-91).
- Kjellberg, A., and Landstrom, U. (1994). Noise in the Office: Part II - The Scientific Basis (Knowledge Base) for the Guide. *International Journal of Industrial Ergonomics* (Vol. 14, pp. 93-118).
- Klemmer, A. P., Klemmer, R. N. (1934). "Subacute Caterial Endocarditis", *International Record of Medicine*. Taubman Medical.
- Konz, S. (1994). Standing. *Ergonomics* (Vol. 37, No. 4, pp. 677).
- Konz, S., (1994). *Ergonomics* (Vol. 37, No. 4, pp. 677).
- Kumar, S., (1995). "Development of Predictive Equations for Lifting Strength," *Applied Ergonomics* (Vol. 26, No. 5, pp. 327 - 341).
- Kumar, S., Narayan, Y., and Bacchus, C. (1995, December). Symmetric and Asymmetric Two-Handed Pull-Push Strength of Young Adults. *Human Factors* (Vol. 37, No. 4).
- Kuorinka, I., and Koshinen, P. (1979). Occupational Rheumatic Diseases and Upper Limb Strain in Manual Jobs in a Light Mechanical Industry. *Scandinavian Journal of Work, Environment & Health* (Vol. 5, No. 3, pp. 39-47).
- Kuorinka, Jonsson, Vinterberg, H., Biering-Soressen, F., Andersson, and Jorgensen, K. (1987, September). Standardized Nordic Questionnaires for the Analysis of Musculoskeletal Symptoms. *Applied Ergonomics*. (pp. 233-237).
- Landis, R. and Koch, G. (1977) The Measurement of Observer Agreement for Categorical Data. *Biometrics* (Vol. 33, pp. 159-174).

- Lavender, S., Thomas, J., Chang, D., and Andersson, B. (1995, December) Effect of Lifting Belts, Foot Movement, and Lift Asymmetry on Trunk Motions. *Human Factors* (Vol. 37, No. 4).
- Levy, Finn and Ramberg, Ingrid.(1986) Eye Fatigue among VDU Users and Non-VDU Users. In *Proceedings of the International Scientific Conference: Work With Video Display Units.*(pp. 42-52) Swedish National Board of Occupational Safety and Health Research Department
- Lewis, W.G., Narayan, C.V. (October 1993). Design and Sizing of Ergonomic Handles for Hand Tools. *Applied Ergonomics* .
- Lifshitz, Y., and Armstrong, T. (1986). A Design Checklist for Control and Prediction of Cumulative Trauma Disorder in Intensive Manual Jobs. In *Proceedings of the Human Factors Society 30th Annual Meeting.* (pp. 945-950).
- Linton, S., Kamwendo, K. (1989, July). Risk Factors in the Psychosocial Work Environment for Neck and Shoulder Pain in Secretaries. *Journal of Occupational Medicine* (Vol. 31, No. 7).
- Loricchio, D., and Lewis, J. (1991) User Assessment of Standard and Reduced-Size Numeric Keypads. *Proceedings of the Human Factors Society 35th Annual Meeting-1991.*
- Loslever, P., and Ranaivosoa, A. (1993). Biomechanical and Epidemiological Investigation of Carpal Tunnel Syndrome at Workplaces with High Risk Factors. *Ergonomics* (Vol. 36, No. 5, pp. 537-554).
- Luczak, H., Cakir, A., Cakir, G. (1992, Sept. 1-4). Work with Display Units 92, Selected In *Proceedings of the Third International Scientific Conference on Work with Display Units.* Berlin, Germany.
- Maclure, M. and Willet, W. C. Misinterpretation and Misuse of the Kappa Statistic. *American Journal of Epidemiology* (Vol. 126, No. 2, pp. 161-169).
- Marley, R. and Kumar, N. (1996). An Improved Musculoskeletal Discomfort Assessment Tool. *International Journal of Industrial Ergonomics.* (Vol. 17, pp. 21-27).
- Marquie, B.T., and Baracat, B. (1994). Age Influence on Attitudes of Office Workers Faced with New Computerized Technologies. *Applied Ergonomics* (Vol. 25, No. 3, pp. 130).
- Marras, W.S., Leurgans S.E., Lavender, S.A., Allread, G.S., Fathallah, F.A., Ferguson, S.A., Rajulu, S.L. (1993) "Three Dimensional Dynamic Trunk Motions, Workplace

Factors, and Occupational Low Back Disorders," *The Ergonomics of Manual Work*, Taylor and Francis, Ltd. London.

Mattila, M., Karwowski, W., and Vilkkio, M. (1993, December). Analysis of Working Postures in Hammering Tasks on Building Construction Sites Using the Computerized OWAS Method. *Applied Ergonomics* (Vol. 24, No. 6).

McAtamney, L., and Corlett, E.N. (1993). RULA - A Survey Method for the Investigation of Work Related Upper Limb Disorders. *Applied Ergonomics* (Vol. 24, No. 2, pp. 91-99).

McAtamney, L., and Corlett, E.N., (1993). RULA - A Survey Method for the Investigation of Work Related Upper Limb Disorders. *Applied Ergonomics* (Vol. 24, No. 2, pp. 92).

McGehen, F.P., (1977). "When Is a Product Portable?". *Dimensions/NBS*. Washington, D.C.: National Bureau of Standards (pp. 16-19), as cited in *Ergonomic Design for People at Work* (1986). (Vol 2., pp. 420). Eastman Kodak Company.

Meister, D. (1985). *Behavioral Analysis and Research Methods*. New York: John Wiley and Sons.

Military Standard 1472. Human Engineering Design Criteria for Military Systems, Equipment & Facilities.

Mital, A., and Asfour, S.S. (1983). Maximum Frequencies Acceptable to Males for One-Handed Lifting in the Sagittal Plane. *Human Factors* (Vol. 25, No. 5, pp. 563-571).

Mital, A., and Manivasagan, I. (1983). Maximum Acceptable Weight of Lift as a Function of Material Density, Center of Gravity Location, Hand Preference, and Frequency. *Human Factors* (Vol. 25, No. 1, pp. 33-42).

Mital, A., Foononifard, H., and Brown, M.L. (1994, June). Physical Fatigue in High and Very High Frequency Manual Handling - Perceived Exertion and Physiological Indicators. *Human Factors* (Vol. 36, No. 2, pp. 219-231).

Mital, A., Nicholson, A.S., and Ayoub, M.M. (1993). *A Guide to Manual Materials Handling*. London: Taylor & Francis.

Moore, J. (1994, December 1-2). *The Epidemiological Context of Upper Extremity Disorders Associated with Work*. International Conference on Occupational Disorders of the Upper Extremities.

Nachemson, A. and Elfstrom, G. (1970) Intravital Dynamic Pressure Measurements in Lumbar Discs. *Scandinavian Journal of Rehabilitation Medicine - Supplement I*.

- Nagamachi, M. (1995, Jan.) Engineering: A New Ergonomic Consumer-Oriented Technology for Product Development. *International Journal of Industrial Ergonomics* (Vol. 15, No. 1, pp. 3-11).
- Nelson, J.B., and Mital A. (1995). An Ergonomical Evaluation of the Primary Hand Flexibility and Capability Changes with Increases in Examination/Surgical Glove Thickness. *Ergonomics* (Vol. 38, No. 4, pp. 723-734).
- Nichols, H.M. (1967). Anatomic Structures of the Thoracic Outlet. *Clinical Orthopaedics and Related Research* (Vol. 51, pp. 17-25).
- NIOSH, Applications Manual for the Revised NIOSH Lifting Equation. (1994) U.S. Department of Health and Human Services.
- Ohara, H., Aoyama, H., Itani, T., Nakagiri, S., and Wake, K (1976). Occupational Health Hazards Resulting from Elevated Work Rate Situations. *Journal of Human Ergology* (Vol. 5, pp. 173-182).
- OSHA Draft Ergonomic Protection Standard (listed as a risk factor in OSHA's Workplace Risk Factor Checklist).
- Pascarella, E., and Kella, J. (1993, May). Soft-Tissue Injuries Related to Use of the Computer Keyboard: A Clinical Study of 53 Severely Injured Persons. *Journal of Occupational Medicine* (Vol. 35, Number 5, pp. 522-532).
- Punnett, L., Robins, J.M., Wegman, D.H. and Keyserling, M., (1985). "Soft Tissue Disorders In The Upper Limbs Of Female Garment Workers", *Scandinavian Journal of Work and Environmental Health* (pp. 417-425) as cited in Sommerich, C.M., McGlothlin, J. D., Marras., W. S., (1993). "Occupational Risk Factors Associated with Soft Tissue Disorders of the Shoulder: A Review of Recent Investigations in the Literature". *Ergonomics* (Vol. 36, No. 6, pp. 697-717).
- Putz-Anderson, V., (1992). *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London. (pp. 52).
- Putz-Anderson, V., (1992). *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London. (pp. 23).
- Putz-Anderson, V., (1992). *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London. (pp. 66).

- Putz-Anderson, V., (1992). *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limb*. Thoracic Taylor & Francis., London (pp. 68-69).
- Rempel, D., Gerson, J., Armstrong, T., Foulke, J., and Martin, B. (1991). Fingertip Forces while Using Three Different Keyboards. In *Proceedings of the Human Factors Society-35th Annual Meeting*.
- Rempel, D., Honan, M., Serina, E., and Tal, R. (1994) Wrist Postures While Typing on a Split Keyboard at Different Heights. *International Conference of Occupational Disorders of the UE*.
- Repetition Strain Symptoms and Working Conditions Among Keyboard Workers Engaged in Data Entry or Word Processing in the South Australian Public Service. South Australian Health Commission, Epidemiology Branch, Occupational Health Branch. (1984, May).
- Reynolds, J.L., Drury, C.G., and Broaderick, R.L. (1994). A Field Methodology for the Control of Musculoskeletal Injuries. *Applied Ergonomics*. (Vol. 25, No. 1, pp. 3-16).
- Ridyard, D.T., Bobick, T.G., and Starkman, B.S. (1990, November). Ergonomics Awareness Training for Workplace Design Engineers. *Applied Ergonomics Technology, and NIOSH, Applied Occupational and Environmental Hygiene* (Vol. 5, No. 11, pp. 771-781).
- Ryan, G.A., (1989). "Musculoskeletal Symptoms in Supermarket Workers," *Ergonomics* (Vol. 32, No. 4, pp. 359 - 371).
- Sauter, S., Swanson, N. (1994, December). *Keyboard Work, Stress and Upper Limb Disorders*. National Institute for Occupational Safety and Health.
- Sawin, D., and Scerbo, M. (1995, December). Effects of Instruction Type and Boredom Proneness in Vigilance: Implications for Boredom and Workload. *Human Factors* (Vol. 37, No. 4).
- Schulze, J.H. L., Congleton, J.J., Koppa, R.L., Huchingsonm R.D. (1994, August). Effects of Pneumatic Screwdrivers and Workstations on Inexperienced and Experienced Operator Performance. *International Journal of Industrial Ergonomics* (Vol. 16, pp. 175-189).
- Silverstein, B.A., Fine, L.J., and Armstrong, T.J. (1986). Hand Wrist Cumulative Trauma Disorders in Industry. *British Journal of Industrial Medicine* (Vol. 43, pp. 779-782).

- Silverstein, B.A., Richards, S., Alcser, K., and Schurman, S. (1991). Evaluation of In-Plant Ergonomics Training. *International Journal of Industrial Ergonomics*.
- Silverstein, B.A., Fine, L.J., and Armstrong, T.J. (1987). Occupational Factors and Carpal Tunnel Syndrome. *American Journal of Industrial Medicine* (Vol. 11, pp. 343-358).
- Smith, M.J., Carayon, P., Sanders, K.J., Lim, S.Y., and LeGrande, D. (1992). Employee Stress and Health Complaints in Jobs With and Without Electronic Performance Monitoring. *Applied Ergonomics* (Vol. 23, No. 1, pp. 17-27).
- Snook, S.H., Ciriello, V.M., (1991). "The Design of Manual Materials Handling Tasks: Revised Tables of Maximum Acceptable Weights and Forces." *Ergonomics* (Vol. 34, No. 9., pp. 1210).
- Snook, S., Vaillancourt, D., Ciriello, V., and Webster, B. (1994, April 15). Psychophysical Studies of Repetitive Wrist Flexion and Extension. *Ergonomics*.
- Sommerich, C.M., McGlothlin, J.D., Marras, W.S. (1993). Occupational Risk Factors Associated with Soft Tissue Disorders of the Shoulder: A Review of Recent Investigations in the Literature. *Ergonomics* (Vol. 36, No. 6.)
- Sperling, L., Sven, D., Wikstrom, L., Kilbom, A., and Kadefors, R. (1993). A Cube Model for the Classification of Work with Hand Tools and the Formulation of Functional Requirements. *Applied Ergonomics*.
- Starr, J. Steven. Effects of Video Display Terminals in a Business Office. (1984) *Human Factors* (Vol 3. No. 356. p.354).
- Stetson, D.S., Keyserling, W.M., Silverstein, B.A., and Leonard, J.A., (November 1991). "Observational Analysis of the Hand and Wrist: A Pilot Study." *Applied Occupational and Environmental Hygiene*. DOL & State of Washington (Vol. 6, No. 11, pp. 927 - 937).
- Tanaka, S., McGlothlin, J. (1993). A Conceptual Quantitative Model for Prevention of Work-Related Carpal Tunnel Syndrome (CTS). National Institute for Occupational Safety and Health. *International Journal of Industrial Ergonomics*.
- The Newsletter of the Center for Office Technology. (1992, September/October). (Vol. 8, No. 5).
- Thomas, R. G., van Baar, C. E., and Van der Stee, M. J. (1995). Baggage Handling: Posture and the Design of Conveyors. *Applied Ergonomics* (Vol. 26, No. 2, pp. 123-127).

- Tyson, R.R., and Kaplan, G.F. (1975). Modern Concepts of Diagnosis and Treatment of the Thoracic Outlet Syndrome. *Orthopaedics Clinics of North America* (Vol. 6, pp. 507-519).
- U. S. Department of Labor, Occupational Safety and Health Administration, (1995) *Draft Ergonomics Protection Standard*. Washington, D. C.
- U. S. Department of Labor, Occupational Safety and Health Administration, (1970). *Occupational Safety and Health Act and Implementing Regulations*. Washington, D.C.
- U.S. Department of Labor. Division of Occupational Analysis, United States Employment Service, Employment & Training Administration- *Guide to Job Analysis. A "How-to" Publication for Occupational Analysts*. Washington, D. C.
- U.S. Department of Labor.(1991) *Dictionary of Occupational Titles*. Washington, D. C.
- Ulin, S.S., Armstrong, T.J., Snook, S.H., Monroe-Keyserling, W. (1993). Examination of the Effect of Tool Mass and Work Postures on Perceived Exertion for a Screw Driving Task," *International Journal of Industrial Ergonomics* (Vol. 12, pp. 105-115).
- USAF Technical Report on Indoor Air Quality, (pp. 24).
- Van Cott, H.P., and Kincade, R.G., (1972). *Human Engineering Guide to Equipment Design*. (pp. 72). Washington D.C., U.S. Government Printing Office.
- Van Wely, P. (1970). Design and Disease. *Applied Ergonomics* (Vol. 1, No. 5, pp. 262-269).
- Washburn, R.A. and Montoye, H.J. (1986). The Assessment of Physical Activity by Questionnaire. *American Journal of Epidemiology* (Vol. 123, No. 4, pp. 563 to 575).
- Waters, T., V. Putz-Anderson., A.Garg., (1994). *Applications Manual for the Revised NIOSH Lifting Equation*. U.S. Department of Health & Human Services, Centers for Disease Control, Cincinnati, Ohio
- Wells, J.A., Zipp, J.F., Schuetter, P.T. and McEleney, J., (1983). "Musculoskeletal Disorders Among Letter Carriers". *Journal of Occupational Medicine* (pp. 814-820), as cited in Sommerich, C.M., McGlothlin, J. D., Marras., W. S. , (1993). "Occupational Risk Factors Associated with Soft Tissue Disorders of the Shoulder: A Review of Recent Investigations in the Literature". *Ergonomics* (Vol. 36, No. 6, pp. 697-717).

- Wells, R. (1994, December 1-2). Biomechanical Models of CTD's/International Conference on Occupational Disorders of the Upper Extremities. Faculty of Applied Health Sciences, University of Waterloo, Ontario, Canada.
- Wiker, S.F., Chaffin, D.B., Langolf, G.D. (1989). "Shoulder Posture and Localized Muscle Fatigue and Discomfort", *Ergonomics* (Vol. 32, No. 2).
- Wiktorin, C., et al. (1991). Design and Reliability of a Questionnaire for Estimating of Physical Load on Epidemiological Studies. In *Proceedings of International Ergonomics Association* (199: 230-232).
- Wiktorin, C., Karlqvist, L., et al. (1993). Validity of Self-Reported Exposures to Work Postures and Manual Materials Handling. *Scandinavian Journal of Work, Environment & Health* (Vol. 19, pp. 208-214).

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