COMPUTER WORKSTATION ERGONOMICS

PURPOSE

The purpose of this guideline is to provide managers and supervisors with information and suggestions that will reduce the incidence of ergonomics related problems often associated with the use of computer workstations. This guideline will also help answer questions related to the health effects of computer use and thereby assist in creating an environment which will result in healthier more productive employees.

INTRODUCTION

The efficient, safe and trouble-free operation of computers depends largely on five key elements.

1. Maintaining a favorable personal attitude toward the supervisor, job, and other employees.
2. Using equipment and furniture that provides a comfortable work station.
3. Providing a physical environment that is comfortable and in which temperature, humidity, noise and lighting are well controlled.
4. Attending to personal factors such as eye care, stress reduction and other factors which help to generate and maintain employee wellness.
5. Effective communication between employees and management that involves workplace surveillance, training, and employee feedback.

HEALTH AND SAFETY CONCERNS

Health effects related to the use of computers fall into the following categories:

1. Musculoskeletal complaints, especially "aches and pains" of the shoulders, neck, legs and back.
2. Tendonitis or other repetitive motion disorders of the hand, wrist, and arm.
3. Eye strain, fatigue, irritation and temporary changes in vision.
4. Headache, nervousness, irritability and other symptoms often associated with stress and fatigue.

Studies reveal that essentially all workers who spend long periods of time performing office tasks at one time or another have one or more of the above symptoms or complaints. These are usually more prevalent among computer operators whose tasks require significant data entry.

The following sections provide information on methods and techniques that will reduce the incidence of health related problems and complaints and improve the overall comfort and mental attitude of employees, particularly those whose jobs require them to spend the major portion of their day working at a computer.

Musculoskeletal and Repetitive Motion Complaints

Musculoskeletal complaints are common among computer operators who perform intense word processing and data entry tasks. Maintaining the body in the same position for long periods

causes “static loading" on the musculoskeletal system. Eventually fatigue and soreness may result from this prolonged muscle tension.

Repetitive motion injuries/illnesses of the wrist and lower arm are also a concern. These problems often result from continuous repetitive finger motions from intensive data entry and keyboarding jobs. These can be prevented.

In addition, mental stress arising from high work loads and intense concentration usually aggravates the severity of ergonomic related problems. Factors which will alleviate some of these effects include improvements in equipment, improved lighting, modifications to workstation layout, changes in work practices, better use of work breaks, and better control of the environmental aspects of the workplace, all of which will be discussed later in this guideline.

Radiation

Measurements made on various makes and models of VDT equipment have indicated that the amount of ionizing radiation emitted such as x-rays or gamma radiation results in exposures which are far below those experienced from normal background and other radiation sources (see Table I). Similarly, emissions in nonionizing regions of the electromagnetic spectrum (e.g., microwaves, radiowaves) fall well within acceptable limits. Therefore, there is no reason to suspect damaging health effects from radiation.

TABLE I

Ionizing Radiation Doses

Legal Limit (public)	500	mrem/year
Dental X-ray	10	mrem
Natural Background	80	mrem/year
Chest X-ray	100	mrem
Transcontinental Flight	3	mrem
Computer Work	0.2	mrem/year

millirem (mrem) - a measure of the amount of radiation (energy) absorbed by the human body

Eyes and Vision

Complaints associated with the continuous use of computers include eye irritation, dryness and fatigue (tired eyes). These complaints may be related to screen quality or to environmental conditions such as air movement and relative humidity.

EQUIPMENT AND WORKSTATION DESIGN

The primary method for minimizing the incidence of problems and complaints stated above is proper work station design.

Each workstation should be designed as a unit based on the specific needs of the employee performing the job and the type of work which will be performed. When purchasing equipment; every effort should be made to obtain as much "adjustability" as possible. However, for existing equipment which is not adjustable, it is usually possible to make modifications which will meet

the basic comfort and use needs of the employee currently using the workstation. Basic Requirements include:

A. A chair with an adjustable back rest (angle and height) for lumbar support
B. A chair with a five leg base
C. A viewing distance from the monitor of about 18-24 inches,
D. A viewing angle 10-20 degrees downward from the horizontal,
E. A detachable keyboard (preferred),
F. A table height 26-29 inches
G. An adjustable keyboard slope.

The following recommendations from the 3-M company may also improve employee health and well being:

1. Place the monitor directly in front of you while at the keyboard
2. Position the top of the monitor screen at or below eye level and about an arm's length away
3. Tilt or swivel the monitor screen to eliminate reflections on the screen or add an anti-glare filter
4. Reduce glare on work surfaces by decreasing overhead lighting and using window shades effectively
5. Add a task light to illuminate documents properly
6. Use a document holder to place source documents as close to the screen as possible and at the same height and distance
7. Place mouse and other input devices next to the keyboard
8. Allow ample clearance to move knees and legs under the keyboard support
9. Block noise with fabric partitions or use earplugs, music or a small fan to mask noise
10. Adjust the height of the chair to achieve a proper posture
11. Adjust the keyboard or chair height to keep forearms, wrists and hands in a straight line while using the keyboard
12. Select a chair that allows clearance behind knees when seated against the backrest
13. Use the backrest of the chair to provide full support particularly for the lower back
14. Sit with head and neck in upright position, even while on the telephone
15. Keep shoulders relaxed and elbows close to the body
16. Maintain a proper posture having a 90 degree or greater angle at the hips and knees while the feet are supported by the floor or footrest.

This above list is intended to provide suggestions for improving employee comfort and productivity. **Individuals must determine how best to apply the suggestions to their work environments.**

Screen Quality.

Visual comfort and problem free operation of computers depends largely on the resolution of the image displayed on the monitor. Characters which are small, blurry, too bright or dim quickly cause eye fatigue and headaches or may even lead to ergonomics related problems. The optimum character size varies with distance and application. For word processing characters that correspond to about a 12 point type with a height to width ratio between 1: 1.7 and 1: 1.9 are

recommended. Brightness and contrast should be adjusted to the operator's preference and this usually depends upon ambient lighting conditions. The operator should strive to achieve the sharpest characters possible at a brightness that appears comfortable under existing ambient lighting conditions.

PHYSICAL ENVIRONMENT

Temperature/Humidity

People who have more sedentary jobs tend to need warmer working conditions with less air movement. A temperature of about 68-74 degrees is adequate for most people. Maintaining relative humidity above 30% reduces static electricity and improves overall comfort. People who wear contact lenses may develop "dry eyes", especially when air movement generated by heating and air conditioning systems, and equipment cooling fans, impinge on the operator's face. Indoor air quality resulting either from internal sources (smoking, copy machines, etc.) or from poor outdoor air quality further aggravate the situation.

Noise

The office is not generally a noisy environment. However, many noise sources such as heating and air conditioning systems, fans, machines, printers, etc. cause "background" noise. Reasonable background noise (under 55 decibels) is beneficial since it tends to mask (drown out) more disturbing noises such as conversations. However, when background noise exceeds this level, or intermittent noise from localized sources becomes annoying, controls may be necessary.

Common methods used for controlling worker noises are (a) use of acoustical partitions as dividers between workstations, (b) isolation of printers and other noisy equipment and (c) installation of acoustical covers which are now available for most printers. Reduction of background noise may require modifications to heating, ventilation and air conditioning systems, closing windows or turning off background music.

Lighting

Illumination for general office areas should be in the range of 50-100 foot-candles. High illumination levels in areas where computers are used reduce screen contrast and cause glare and reflection on the monitor surface. Possible solutions to these problems include rearranging workstations or repositioning lights. This is often helpful in improving screen viewing characteristics. Overhead lights cause reflections when positioned behind, washout the image when positioned above and blind the operator when positioned forward. Some experimentation may be necessary to properly position workstations to avoid lighting problems. Another option is the use of anti-glare filters that can be attach directly to the surface of a monitor to reduce reflections and glare.

Vision Testing/Correction

Vision testing should be provided at least every two years for employees required to operate a computer as a regular part of their job. The tests should include:

- Evaluation of physical abnormalities.
- Testing of visual acuity at approximately 20 inches in addition to the standard near and far vision test.

- Evaluation of other conditions which may lead to eye irritation or visual problems (allergies, glaucoma, etc.).

Work Breaks/Exercise Programs

Jobs which require heavy workloads, rigid deadlines or cause other potentially stressful conditions are particularly prone to causing mental and musculoskeletal fatigue, and result in a higher incidence of visual, ergonomics and other health related complaints. Exercise breaks reduce these problems and help the computer operator become happier and more productive.

Brief (one to two minute) unscheduled "mini-breaks" about every 20-30 minutes are considered to be more effective than less frequent but longer break periods. These "mini breaks" may be used to perform alternate tasks, such as filing or using the telephone. They can also be used for doing exercises designed to reduce eye fatigue, loosen muscles and improve circulation. Some physical exercises designed for computer operators during mini breaks follow:

Deep Breathing

Breathe in slowly through the nose, hold for 2 seconds, and then exhale through the mouth. Repeat cycle several times.

Head & Neck

Turn head slowly from one side to the other, holding each turn for the count of three. Repeat 5-10 times.

Upper Back

With arms folded at shoulder height, push elbows back, hold a few seconds. Repeat 5-10 times.

Shoulders

Roll shoulders forward 5 times using a wide circular motion, then roll shoulders backward 5 times.

Wrist

Hold your hands in front of you. Raise your hands to stretch the muscles in the forearm. Repeat several times.

Fingers and Hands

Make a tight fist with your hands, hold for a second then relax. Repeat 5 times. Then spread your fingers wide apart, hold for a second then relax, Repeat 5 times.

Lower Back

While sitting. Slowly bend your upper body between your knees. Hold for a few seconds then sit up and relax. Repeat several times.

Legs

Grasp the shin of one leg and pull slowly toward your chest, Hold for 5 seconds. Then do the other leg. Repeat.

Eyes
Eye exercises such as rolling the eyes, blinking, closing them tightly for a few seconds or looking at distant objects are helpful in relieving eye strain.

A longer scheduled break of 10-15 minutes every two hours is suggested for exercising, relaxing, socializing or for quiet meditation.

Questionnaires
The attached questionnaires, checklists and survey forms may be useful in identifying specific problems and complaints which currently exist.

Training
New VDT operators should be familiarized and properly "fitted" with their workstation. This training should include:

A. Review of adjustable features of the workstation and desirable for maintaining optimum comfort and convenience.
B. Discussion of any visual, ergonomic and/or related health concerns.
C. Examination of environmental conditions such as lighting (glare), ventilation (drafts), etc.
D. Discussion of policies and recommendations regarding work breaks, exercise routines, etc.

Communication
A system should be established for answering questions, hearing complaints and obtaining suggestions that employees may have. Periodic review of the training steps is recommended. **Effective communication between employees and management is extremely important and will be the key to either the success or failure of your company's efforts to minimize musculoskeletal and repetitive motion type illness/injuries from computer work.** The communication process should involve workplace surveillance, training, and employee feedback.

Acknowledgments
Some of the information in this guideline was modified from information from the Johnson & Johnson Company and the 3-M Company.

General Survey Information

Name: _____ Date: _____

Department/Area: _____ Job: _____

How long have you been using a computer at your job? _____

Type of computer: Manufacturer? _____

Model? _____

What is a typical amount of time you work at your computer without an interruption or break?

Percent of day you spend working at your computer? _____

Percent of day you spend using the telephone? _____

Would a headset phone be practical at your workstation? _____

Can you alternate your work pattern (with filing, phone calls, breaks, etc.) so that you are not captive to the computer for long periods of time? _____

Do you feel more fatigued at any specific time of day? _____

Do you feel that simple stretching/tension relieving exercises, which could be performed at your desk, should be developed? _____

-If not, for what reason _____

What changes would you like to see made to make your work at your computer more efficient, comfortable or convenient if any changes are necessary?

_____

_____

_____

_____

_____

_____

_____

_____

Work Environment Survey

Name: _____ Date: _____

Department/Area _____ Job: _____

Indicate whether any of the following conditions tend to be a problem when you are performing your job.

	Never	Sometimes	Frequently	Constantly
Temperature	0	1	2	3
Drafts	0	1	2	3
Odors	0	1	2	3
Cigarette Smoke	0	1	2	3
Equipment Noise	0	1	2	3
Other Distracting Noise	0	1	2	3
Chair Seat Comfort	0	1	2	3
Chair Backrest Comfort	0	1	2	3
Leg room	0	1	2	3
Work place Layout/Organization	0	1	2	3
Desk/Table Height	0	1	2	3
VDT Screen Height	0	1	2	3
Keyboard Height	0	1	2	3
Lack of Arm Rests	0	1	2	3
Lack of Wrist Rests	0	1	2	3
Amount of Light	0	1	2	3
Glare from Lights	0	1	2	3
Reflections on Desk	0	1	2	3
Reflections on Monitor	0	1	2	3
Dust/Soil on Monitor	0	1	2	3
Dust/Soil on Glare Screen (If Used)	0	1	2	3

Health Symptoms Survey

Name: _____ Date: _____

Department/Area: _____ Job: _____

The following is a list of symptoms which you may or may not experience. Please try to answer each question as it pertains to the time you are at work or the time period shortly after leaving work. Only indicate those symptoms which you have experienced within the past 6 months.

	Never	Sometimes	Frequently	Constantly
Pain or stiffness in your arms	0	1	2	3
Pain or stiffness in your shoulders	0	1	2	3
Pain or stiffness in your neck	0	1	2	3
Pain or stiffness in your back	0	1	2	3
Pain or stiffness in your legs	0	1	2	3
Pain or stiffness in your feet	0	1	2	3

Numbness or tingling in your fingers/hands	0	1	2	3
Numbness or tingling in your arms	0	1	2	3
Numbness or tingling in your shoulders	0	1	2	3
Numbness or tingling in your neck	0	1	2	3
Numbness or tingling in your back	0	1	2	3
Numbness or tingling in your legs	0	1	2	3
Numbness or tingling in your feet	0	1	2	3

Cramps or fatigue in your fingers/hands	0	1	2	3
Cramps or fatigue in your arms	0	1	2	3
Cramps or fatigue in your shoulders	0	1	2	3
Cramps or fatigue in your neck	0	1	2	3
Cramps or fatigue in your back	0	1	2	3
Cramps or fatigue in your legs	0	1	2	3
Cramps or fatigue in your feet	0	1	2	3

Irritated or burning eyes	0	1	2	3
Irritated or itching skin	0	1	2	3
Blurred vision/Difficulty focusing	0	1	2	3
Headaches	0	1	2	3
Irritability /Nervousness	0	1	2	3

Other symptoms_____

What do you think is causing the problems (if any)? _____

_____

Are you currently receiving treatment (medical, chiropractic, etc.) for any condition which includes any of the above symptoms (e.g. back pains, arthritis)? _____

COMPUTER WORKSTATION CHECKLIST

Name: _____ Date: _____

Department/Area: _____ Job: _____

1. Does the workstation lend itself to proper posture?
   - Y N thighs horizontal
   - Y N feet on a foot rest
   - Y N back and shoulders
   - Y N relaxed lower legs vertical
   - Y N wrists neutral
   - Y N neck relaxed
2. Does the chair used:
   - Y N adjust easily?
   - Y N have a padded seat with a rounded front?
   - Y N have an adjustable backrest?
   - Y N have lumbar support?
   - Y N have a 5 leg base with 5 casters?
3. Is the keyboard work surface:
   - Y N height adjustable?
   - Y N tilt adjustable?
4. Y N Is the keyboard detachable?
5. Y N Does keying require minimal force?
6. Y N Does the thickness of the keyboard affect wrist posture?
7. Y N Is there an adjustable document holder?
8. Y N Are arm rests provided where needed?
9. Y N Are glare and reflections avoided?
10. Y N Do the computer monitors have contrast and brightness controls?
11. Y N Is there proper distance between eyes and work?
12. Y N Is there sufficient space for knees and feet?
13. Y N Is the workstation biased toward right or left hand work?
14. Y N Are adequate rest breaks provided for task demands?
15. Are high stroke rates influenced by:
    - Y N incentive systems?
    - Y N work flow?
    - Y N job design?
    - Y N other pressures?
16. Are high key stroke rates avoided by:
    - Y N job rotation?
    - Y N job enlargement?
    - Y N self pacing?
    - Y N adjusting the job to the skill of the worker?

17. Are employees trained in:
    - Y N proper postures?
    - Y N proper work methods?
    - Y N when and how to adjust their workstations?
    - Y N how to seek assistance with concerns?

NOTE: This document is not intended to be legal advice. It does not identify all the issues surrounding the particular topic. Public agencies are encouraged to review their procedures with an expert or an attorney who is knowledgeable about the topic. Reliance on this information is at the sole risk of the user.

P.O. Box 1270 • 535 Adams Avenue • Montgomery, AL 36102
Phone: (334) 262-2566 • FAX: (334) 262-2809