VILLAGE OF BLOOMINGDALE
OFFICE SAFETY/ERGONOMICS

I. INTRODUCTION
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New office technology and automation has brought with it a new set of health and safety concerns. The nature of today's office work has produced stress-related symptoms and musculoskeletal strains. The leading types of disabling accidents that occur within the office are the result of falls, strains and overexertion, falling objects, striking against objects, and being caught in or between objects.

II. OFFICE SAFETY

A. **Falls** are the most common office accident, accounting for the greatest number of disabling injuries. Most causes of falls can be prevented by practicing the Village's general housekeeping practices. The most common causes of office falls are:

1. Tripping over an open desk or file drawer.

2. Bending while seated in an unstable chair. Avoid excessive bending, twisting, and leaning backward while seated.

3. Tripping over electrical cords or wires are other common hazards.

4. Using a chair or stack of boxes in place of a ladder. Always use a stepladder for overhead reaching.

5. Slipping on a wet floor, loose carpeting, or objects stored in halls or walkways.

6. Roll, Don't Reach. If you find yourself heading for a fall, let your body crumple and roll, you are more likely to absorb the impact and momentum of a fall without injury. Reaching an arm or leg out to break your fall may result in a broken limb instead.

B. **Strains** don't only occur by lifting large or heavy objects. Small, light loads (i.e., stacks of files, boxes of computer paper, books) can wreak havoc on your back, neck, and shoulders if you use your body incorrectly when you lift them. Backs are especially vulnerable; most back injuries result from improper lifting. Before you pick up a carton or load, identify how high and far it needs to be carried, and whether it is too heavy or awkward to lift/carry alone. Don't try to impress anyone! If the lift is beyond your ability, contact your supervisor or ask another employee to assist you, and use the safe listing steps in the Back Injury Prevention section.

C. **Striking Against** doors, desks, file cabinets, open drawers, and other people while walking. Striking the head on open file drawers while straightening after bending down, against sharp objects such as office machines, spindle files, staples, and pins. Pay attention to where you are walking at all times, properly store materials in your work area and never carry objects that prevent you from seeing ahead of you. Objects striking employees occur as a result of:

1. Office supplies sliding from shelves or cabinet tops.

2. Overbalanced file cabinets in which two or more drawers were opened at the same time or in which the file drawer was pulled out too far.

3. Machines, such as typewriters that were dropped on feet.

4. Doors that were opened suddenly from the other side. Be cautious when approaching a door that can be pushed towards you, and push door cautiously when on the other side.

5. Proper material storage and use of storage devices can avoid these accidents.

D. **Being Caught In or Between Objects** result from fingers or articles of clothing caught in or between objects as a result of:

1. Fingers caught in a drawer, door, or window.

2. Fingers, hair or articles of clothing and jewelry caught in office machines.

3. Fingers caught under the knife-edge of a paper cutter. Keep the blade of the paper down when not in use.

4. Carry all sharp objects pointed down.

5. While working with office equipment, concentrate on what you are doing.

E. **Falling Objects** result from improper storage, disorderly piling, piling materials too high, and obstructing doors, aisles, fire exits and fire-fighting equipment. The following are good storage practices:

1. Boxes, papers, and other materials should not be stored on top of lockers or file cabinets because they can cause landslide problems.

2. Boxes and cartons should all be of uniform size in any pile or stack. Always stack material in such a way that it will not fall over.

3. Heavy objects should be stored on lower shelves.

4. Try to store materials inside cabinets, files, and lockers.

5. Office equipment such as typewriters, index files, lights or calculators should not be placed on the edges of a desk, filing cabinet, or table.

6. Aisles, corners, and passageways must remain unobstructed. There should be no stacking of materials in these areas.

7. Storage areas should be designated and used only for that purpose. Store heavy materials so you do not have to reach across something to retrieve them.

8. Fire equipment, extinguishers, fire door exits, and sprinkler heads should remain unobstructed. Materials should be at least 18 inches minimum away from sprinkler heads.

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III. **WORKSTATION ERGONOMICS**

A. Ergonomics involves fitting the workplace to the worker by modifying or redesigning the job, workstation, tool, or environment. Workstation design can have a big impact with office workers health and well being. There are a multitude of discomforts which can result from ergonomically incorrect computer workstation setups.

B. The most common complaints relate to the neck, shoulders, and back. Others concern the arms and hands and occasionally the eyes. For example, poor chairs and/or bad postures can cause lower back strain; or a chair that is too high can cause circulation loss in legs and feet.

C. The key to comfort is in maintaining the body in a relaxed, neutral position. The ideal work position is to have the arms hanging relaxed from the shoulders. If a keyboard is used, arms should be bent at right angles at the elbow, with the hands held in a straight line with forearms and elbows close to the body. The head should be in lined with the body and slightly forward.

D. There are some physical measurements in the guidelines below. Following these guidelines will likely improve the ergonomics of workstations and should help defend against repetitive stress injuries.
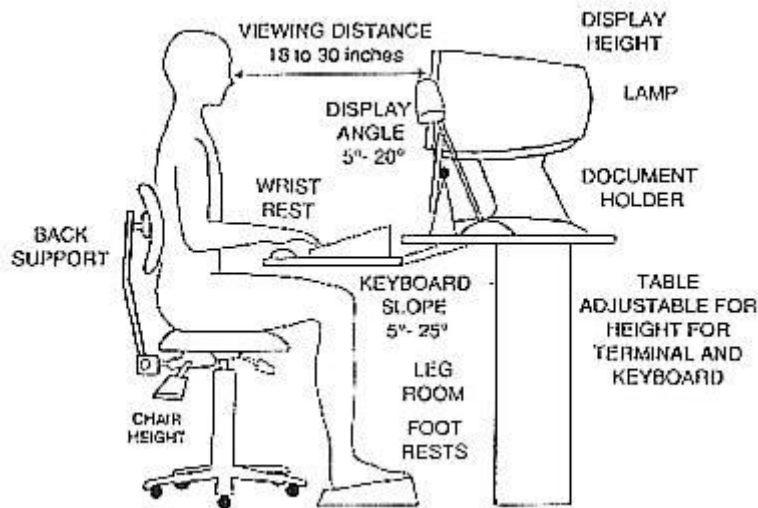
E. Refer to the diagram above. The chair seat and workstation tabletop may work fine within the acceptable range, but the key guideline is to keep the correct 90 degree angle between back and upper legs, between upper and lower legs, and between upper and lower arm, while at the same time keeping the head up and the feet flat on a support surface.

F. If the "right" measurements do this, all well and good, but if you are not the right size for these measurements to be effective, arrange yourself and your workstation to keep your body positioned correctly regardless of the measurements.

G. Making the workstation ergonomically safe is most difficult for workstations shared by two or more workers. No two workers are shaped exactly the same. The key is to

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build in as much flexibility as possible so that each worker can make adjustments when first sitting at the workstation.

IV.   CHAIRS

A. **Legs** -- Chair should have 5 legs for stability and appropriate casters for easy movement while seated.

B. **Height** -- Seat height should be pneumatically adjustable while seated. A range of 15-21 inches off the floor should accommodate most users. Thighs should be horizontal, lower legs vertical, feet flat on the floor or on footrest. Seat height should also allow a 90 degree angle at the elbows for typing.

C. **Seat** -- A seat width of 17-20 inches suffices for most people and should be deep enough to permit the back to contact the lumbar backrest without cutting into the backs of knees. The front edge should be rounded and padded. The seat slant should be adjustable (0 to 10 degrees). Avoid bucket-type seats. The seat should swivel easily.

D. **Backrest** -- The backrest should offer firm support, especially in the lumbar (lower back) region, should be 12-19 inches wide, and should be easily adjustable both in angle and height, while sitting. The optimum angle between seat and back should permit a working posture of at least 90 degrees between the spine and thighs. Seat pan angle and backrest height and angle should be coordinated to allow for the most comfortable weight load on the spinal column.

E. **Padding** -- A chair seat and back should be padded enough to allow comfortable circulation. If a seat is too soft, the muscles must always adjust to maintain a steady posture, causing strain and fatigue. The seat fabric should "breathe" to allow air circulation through clothes to the skin.

F. **Armrests** -- Armrests are optional, depending on user preference and tasks performed. They should not restrict movement or impede the worker's ability to get close enough to the work surface. The typist should not rest his or her forearms on armrests while typing.

V.   TABLES AND WORK SURFACES

A. **Copy Stand** - Use of a copy holder-instead of resting copy on the table top-helps eliminate strain and discomfort by keeping the copy close to the monitor and at the same height and distance from the user's face as the screen.

B. **Bi-Level** - User comfort (and strain avoidance) dictate that the keyboard should be at a lower level than the screen so that the screen can be viewed comfortably and the keyboard used comfortably. The familiar arrangement of stacking the monitor on the computer while keeping the keyboard on the table top can be successful. Another possibility is to use a special lower shelf for the keyboard. This may be especially useful when the table top is also needed as a writing surface-writing height for an individual is usually higher than that person's keyboard height.

C. **Height** - Correct table height depends upon the user of a workstation and upon the chair and other factors that interact with the user and table. The ideal is for the user

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to be able to sit at the table with the keyboard in place and be able to easily maintain a 90° elbow angle and straight wrists while typing. The height of an adjustable keyboard support should adjust between 23" and 28" to accommodate most-but not all-users. 26" is a recommended compromise position, while leg clearance must still be considered.

D. **Surface Area** - The table top should be big enough to allow space not only for all computer-related necessary equipment, but also for paperwork, books, and other materials needed while working at the computer. Working with materials on chairs and at odd angles has the potential for neck and other body strain. Frequently used items should be kept close to avoid long reaches. A general recommendation is that the table top should be at least as big as the standard office desk -- 30" by 60". A depth of at least 30" allows flexibility in use/reuse of the table. Usable space may be maximized by good wire/cable management.

E. **Leg Room** - Knee spaces should allow a worker to feel uncrowded and to allow some changes of position -- even with the keyboard support lowered to the correct level for use. The knee space should be at least 30" wide by 19" deep by 27" high to comply with the requirements of the Americans with Disabilities Act. Leg clearance should be greater than the height of the thigh and knee of the largest person using the workstation; for those using a footrest, clearance must be calculated with the legs in place on the footrest. Likewise, depth of the "clearance envelope" for both knees and toes should be evaluated while the workstation user is in a normal working position at the table (determined by the design of the seating system and the way the user sits). Drawers and support legs (for furniture) should not go where human legs need to fit.

F. **Footrests** - Situations will arise in which a user is perfectly adjusted for keyboard use and with the monitor at a correct angle, but her/his feet do not rest flat on the floor. A footrest may be used to correct this problem.

G. **Edges** - Table edges should be smoothed or rounded to avoid discomfort on the part of the user as hands, arms, and wrists contact the table.

H. **Construction** - Sturdily built tables help avoid irritating vibrations.

I. **Surfaces** - Medium and light-colored surfaces may help avoid excessive contrast with printed materials. A non-shiny surface is recommended to help in reducing glare.

VI. **COMPUTER HARDWARE**

A. **Monitors**

   1. Selection
      a. "Refresh rate" refers to how often a screen image is "redrawn." Too slow a refresh rate produces noticeable screen flicker, contributing to eyestrain. The minimum refresh rate for the selected monitor should be 70 MHz.
      b. The monitor should be of the non-interlaced type.
      c. The monitor should be of a tilt-swivel type, to enable the user to adjust its positioning for optimum ergonomic benefit, i.e., to minimize neck twisting and craning.

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    d. Monitor screens should be as flat as possible, to minimize potential focus problems.

    e. The selected monitor must comply with MPRII guidelines (guidelines of the Swedish National Board of Testing).

    f. When selecting an LCD (liquid crystal diode) monitor or screen, the active matrix type offers the clearest image for minimizing eyestrain.

B. Use

1. Optimum monitor distance from the eyes is between 18 and 24 inches. Closer distance magnifies possible eyestrain, and dust and radiation exposure.

2. The top of the screen should be at eye level, or not more than 15 degrees below eye level. If lower than this, the monitor should be raised by means of a monitor stand or other stable lift.

3. If the monitor offers a manual focus adjustment, use it frequently to ensure the image is as sharp as possible.

4. The electrical charges in monitors attract much dust. Clean the screen frequently to keep the image sharp.

5. Eliminate or reduce screen glare by keeping direct light sources away from the screen. Use indirect lighting if possible. Don't position the monitor in front of a brighter light source.

6. If glare can be reduced only through the use of an optional anti-glare attachment, make sure it has an AOA (American Optometric Association) Seal of Acceptance.

7. A monitor that utilizes dark letters on a light background, or that offers this setup option, is preferable to reduce eyestrain. In building your monitor's "desktop" or creating a document, avoid using red or blue for either the background-where they tend to be brighter than the work document-or for the regular font (text) color-where they are less distinct.

C. Safety

1. Monitors not only attract dust but repel it toward the face. Keeping the screen free of dust also minimizes potential allergic reactions.

2. Monitors are a source of radiation. While some dangers thought to exist have been found to be minimal, others are still being studied. Radiation is most prevalent out the backs and sides of monitors. Workstations backing upon one another should be at least 48 inches apart. Workstations placed side-by-side should be at least 36 inches apart.

3. For optimum radiation safety, turn off the monitor when not in use. On most new workstations this can be done without shutting down the computer.

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D. Keyboards

1. **Height** - The keyboard should be placed at approximately seated elbow height. A worker's fingers should fall on the "home" row of keys while the arms fall straight down from the shoulders and the forearms are held parallel to the floor.

2. **Wrists** - Wrists should be held in a neutral position, in line with the forearm, with no bend up, down, or to either side, while typing. When your arms are dangling straight down from the shoulders and relaxed, the wrists are in their natural position. This position should be duplicated as closely as possible while using the keyboard. Studies show that cumulative trauma disorders associated with computer use can be attributed to repetitive movements made while the wrist is bent up, down or sideways from a neutral position. This causes pressure to be exerted on the tendons, nerves, and blood vessels passing through the carpal tunnel.

3. **Arms** - Arms should rest at your sides, with forearms held at approximately a 90 degree angle from the upper arms. Elbows should be kept as close to the body as possible with the shoulders relaxed to reduce strain on the upper body.

4. **Posture** - The head should be kept over the shoulders to reduce strain on the neck and improve blood flow to the upper body. The back should be upright, against the back of the chair, so the weight of the upper body is supported by the chair. The chair should support the natural inward curve of the spine in the lower back. A pillow or rolled towel can be used to provide extra lumbar support if needed.

5. **Pressure** - Moderate to light pressure should be used when typing. Use of excessive force can play a major role in cumulative trauma disorders. Keyboards should be operable with a light touch.

6. **Keyboard slope** - The surface angle of the keyboard should be adjustable so the keys can be reached easily with the wrists in a neutral position. Some keyboards can be placed flat or angled slightly upwards at the back. A new keyboard is on the market that incorporates a negative slope, down and away from the user, and is also advertised as encouraging a neutral wrist position.

7. **Keys** - Keys should be slightly concave on top to conform to the shape of the fingers and to keep them from sliding off keys. Keys should be large enough and should be spaced comfortably.

8. **Finish** - A matte finish in a neutral color is needed to keep glare to a minimum and reduce distraction.

9. **Wrist rests** - Wrist rests should only be used to support the wrists in pauses between typing if this is comfortable for the individual. Placing the wrists on a wrist rest while typing can create a bend in the wrists and pressure on the carpal tunnel. Wrist rests should have rounded not sharp, edges and should provide a firm but soft cushion.

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10. **Split keyboard** - Split keyboards with a raised middle may facilitate a more natural position for the wrists while typing. Many alternative keyboard designs are available, but most are expensive and not widely available. There is much difference of opinion about their effectiveness in preventing cumulative trauma disorders.

E. Mice

1. Always maintain a neutral wrist position, keeping wrists straight and relaxed.

2. If you find it useful, use a mouse wrist support.

3. Never use force when clicking or dragging the mouse.

4. Use the whole arm to move the mouse, rather than just the forearm, which will prevent strain on the hand and wrist muscles.

5. The mouse should be in the "immediate reach zone", avoiding placing it too far away, too low, or extended from the keyboard.

6. Setting the mouse on a platform, slightly above the keyboard, offers natural comfort and maximum hand-eye coordination.

7. If possible, switch the mouse to your other hand occasionally to avoid too much stress on one shoulder and arm.

F. Alternative Input Devices:

There are many alternative input devices available to help reduce keystrokes. Some of these devices may be preferable, but some (notably the trackball) may not be any better than the keyboard or mouse. Whether they are really any better depends on the person's size, personal preferences, state of technology, availability, space, etc.

1. Tablets and pens designed primarily to manipulate on-screen graphic objects.

2. Foot pedals can be used to enter a programmed set of keystrokes.

3. Trackball: a ball mounted directly into the keyboard or in its own case that is rolled to move the cursor. Visualize an upside-down mouse.

4. Touchpad: finger-operated, pressure sensitive pad-such as Apple Computer's Unmouse-that moves the cursor corresponding to the direction the finger moves.

5. Touch screen: a screen that is touched directly to place the cursor or make a choice.

6. Voice activated system (or speech recognition software) that responds to the user's voice.

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G. Other Options

Whenever possible use macros, function keys, "Easy Keys," or other such single key strokes that represent multiple keystrokes to the computer to decrease the number of key strokes you must make. (See appropriate user documentation for more information.)

H. Environmental Factors

1. **Air -** Keep as much fresh air inside as possible-at least two air exchanges per hour. Maintain plenty of air circulation (but not drafts) especially around printers and copiers, but don't direct airflow toward the face.

2. **Dust-** The computer creates an electrostatic field that attracts negatively charged particles, creating a film of dirt and repelling positively charged particles toward the operator's face. Keep dust in the area to a minimum.

3. **Temperature and Humidity-** Maintain a comfortable temperature, from 68-72 degrees F. Maintain the humidity level in the air to about 30-50% relative humidity, but exercise caution as some computer equipment (notably laser printers) cannot operate with higher humidity levels.

4. **Lighting/Glare** - Keep bright lights out of your field of vision. Lights should not flicker. Monitors should be turned 90 degrees from light sources such as windows. Use shades or blinds to dampen outside light. Indirect lighting is preferable, but it should not overpower the brightness of the screen. In general, the luminance of the monitor and the surroundings should vary by no more than a factor of 3, though recent research seems to indicate that a wider variance may be acceptable under certain circumstances. Ambient lighting should be in the 200-500 lux range. Keep luminance in the room at a constant level (i.e., there should be no bright spots). Use task lighting only if necessary; keep it as low as possible to do the job, but no brighter than the screen; and, make sure it does not spill light into your eyes or produce glare on the screen. Tilt the screen as appropriate to avoid glare from overhead sources. Some experts recommend not wearing white clothes which can create more glare on the screen. No one anti-glare device is best for all situations, and some (such as nylon mesh screen covers) are usually counterproductive by making the screen too dark for the surrounding light levels. In general, glare increases with the luminance, size, angle of incidence, and proximity of the source of light to the line of sight.

5. **Noise -** Music, conversations, and other office noise should be low enough so as not to be distracting. Use acoustic panels and ceilings to balance sound. Ambient noise levels should be below 55 decibels.

6. **Radiation -** Modern monitors have much lower radiation levels than earlier models. Maintain space behind monitors where most radiation occurs. No one should be within four feet of the back of a workstation for an extended period (and partitions do not block extremely low frequency (ELF) radiation). Because laser printers and copiers contribute to higher radiation levels, they should be situated away from staff members whenever possible.

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7. **Room surfaces -** Use matte finishes and neutral tones. Avoid pure white or reflective surfaces and avoid gloss or semi-gloss paint. Floors should be carpeted or have a dull finish.

8. **Space -** You should have enough space to adopt various comfortable positions. While privacy may be important, you should be able to easily shift your focus to a distant object. Keep the most frequently used items within easy reach.

9. **Static electricity -** Decrease static in the area by using carpet sprays, increasing humidity levels, etc.

I. HUMAN FACTORS

Once you have a workstation ergonomically suited to you (and remember to adjust your workstation as soon as you sit at it), there are additional steps that you can take to avoid repetitive stress and ensure the success of a healthy working environment.

1. **Relaxation -** Maintain good, relaxed posture. Don't crook the telephone headset between your ear and neck. Keep wrists flat in a neutral position. Use as light a keystroke as possible.

2. **Exercise -** Exercise is one of the key elements in the successful outcome of an ergonomics program. You should move around at least once an hour during intensive computer use. Stretch; use recommended stretching exercises. Shift positions frequently. Vary your work routines; try to mix non-computer work with computer work. Participate in a regular fitness program away from work.

3. **Vision** - Remember to blink! A normal blink rate is once every five seconds. Give your eyes a rest before they tire; close them for a few seconds. Use eye moisturizing drops to help soothe strained or dry eyes. Choose a distant focal point and frequently refocus from the monitor to that object (about every 10 minutes). Get sufficient rest. Schedule an eye exam. Buy computer glasses if recommended. Computer glasses are especially helpful for wearers of bifocal, trifocal, and/or corrective lenses.

4. **Preferred Posture** - Ergonomics, the science of designing workplaces so they fit the person, can help reduce the stress of the repetitive motions you perform at your job. Try adjusting your office furniture so that you can keep your wrists straight while typing. (Typing with your wrists and elbows lower than your fingers is very stressful for the tendons and can put pressure on the main nerve in your hand.) Position your chair high enough so that your elbows are even with, or slightly higher than, your keyboard while you type.

   a. The feet are placed flat on the floor or other support with the thighs horizontal.
   b. Weight is taken on the buttocks and upper part of the thighs only.
   c. The movement of the legs is not restricted.
   d. There is no pressure at the back of the knees or underside of thighs.
   e. The body is held comfortably erect with the back supported in the lumbar region.

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f.   The relative height of the seat and the working surface should be so adjusted that the shoulders are relaxed when the hands are resting on the keyboard. The upper arms should hang naturally with the angle between the forearm and upper arm about 90°, and with a minimum of wrist bending.

g.   The top of the visual display unit screen should be located just below the level of the operator's eyes.

h.   The source material should be positioned at the same height as the screen and at the same distance from the operator's vision, through the use of a document holder.

i.   Setting up your preferred posture position

   i.   Set the backrest lumbar support so it supports the natural curve in your back. The same mechanism that adjusts the angle of the backrest also adjusts seat tilt (most people seem to prefer the seat to be horizontal or tilted slightly forward). Do not adjust the chair so you are leaning backwards.

   ii.   Set your chair height so that your arms make a 90° angle or greater when at the keyboard. If you have a desk with an adjustable keyboard section, adjust it down to achieve the same arm position.

   iii.   If you do not have a desk with an adjustable keyboard section and after adjusting your chair up your feet are dangling, you need a footrest.

   iv.   Your eye level should now be just above the top of the screen, if it is too low you need to raise it, using a terminal elevation box or computer arm.

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