Lighting Ergonomics Guideline
Environmental Health and Safety

1.0 INTRODUCTION

Proper lighting in an office environment can prevent workplace accidents, enhance productivity and quality of work, and prevent eye strain/fatigue and headaches. The purpose of this document is to provide University of Toronto employees with practical advice on how to optimize the lighting in their work environment for better ergonomics, both in the office and at home workstations.

Common lighting problems may include:

- Insufficient lighting
- Poor light distribution/balance
- Glare
- Improper contrast
- Light flickering
- Blue light exposure
- Light sensitivity

The following guidelines were developed following the lighting ergonomics guidelines from the Canadian Standards Association (CSA) and Canadian Centre for Occupational Health and Safety.

For guidance and best practices on computer workstations and workstation setup, refer to the University of Toronto Office Ergonomics Standard and the Environmental Health and Safety (EHS) Office Ergonomics website.

2.0 SCOPE

This guideline applies to all University of Toronto employees who perform moderate and/or intensive computer work but can also be used by Departments/Faculties for employees who perform light computer work.

3.0 RESPONSIBILITIES

All University of Toronto employees should conduct routine inspections of their workspace for lighting issues (e.g., visually check that all light bulbs/tubes are functioning) and report any lighting concerns to their Supervisor/Manager/Principal Investigator and/or Property Manager. If a workplace lighting assessment is required, EHS can be contacted for assistance or consultation.

For employees who may have light sensitivity, consider seeing a healthcare professional and/or contact Health and Well-Being Programs and Services to discuss the possibility of a workplace accommodation.

4.0 DEFINITIONS

Circadian Rhythm	Humans have internal clocks that synchronize physiological functions with the natural day-night cycle (24-hour cycle) through different environmental cues, with the main cue being light. Light exposure stimulates the circadian system, with short wavelengths (blue light) having the greatest effect.
Contrast	The relationship between an object and its background in terms of its colour or brightness.
Direct Lighting	Localized lighting where most of the light falls on a specific area.
Glare	Occurs when a bright light source or reflection interferes with a person's ability to see an object within the field of view. There are two types of glare: direct glare and reflected glare.
	Direct glare: A form of glare that directly enters a person's line of sight.
	Reflected Glare: Also known as "indirect glare" or "glare by reflection". This form of glare is caused by light reflecting off polished, shiny or glossy surfaces.
Illuminance	The amount of light falling on a surface. The unit of measurement is lux (lumens per square meter). Illuminance is measured using a light meter.
Indirect Lighting	General lighting where the light is spread across a large area. Typically, the light from the fixture is directed upwards so that the light is reflected off ceiling and walls.
Light Flicker	Rapid and repeated changes in the brightness of light over time. Light flickering is caused by unwanted fluctuations in the voltage supplied to a light source. It may occur with lighting that requires the use of ballasts to control the electrical supply (e.g., fluorescent lights).
Light Sensitivity	Also known as "photosensitivity". This is a condition whereby a person experiences discomfort or pain from exposure to ordinary light sources.
Lumens	A measure of brightness or light output. A bulb with a higher lumens value provides a brighter light.

5.0 ERGONOMIC LIGHTING STRATEGIES

Illumination

There should be an appropriate amount of light provided at office workstations to perform the work tasks but not excessive amounts that it makes objects difficult to see. The amount of lighting required differs between individuals and should consider the following factors:

- Type of task or activity being performed (e.g., demands for speed and accuracy, nature of task, difficulty of the task, etc.).
- Type of work surface.
- Surrounding lighting environment (e.g., time of day).
- Individual factors (e.g., age of employee, vision needs of employee, etc.).

To ensure sufficient lighting around the workstation:

- Replace light bulbs if they begin to dim with use; older light bulbs produce less light than newer ones.
- Clean light fixtures regularly as dust can reduce the amount of light given off.
- Provide additional light fixtures or task lighting in appropriate places.
- Use light-coloured paint on walls and ceilings to reflect light back into the room.

General reference values for suggested illuminance based on the activity type is summarized in Appendix A. Typically, adequate general lighting is between 500 to 1000 lux.

Light Distribution and Balance

When light fixtures are too widely spaced apart or wrongly positioned, it may result in certain parts of the office interior to be substantially darker than adjacent areas. Considerations for designing lighting and maintenance to eliminate unwanted dark areas and shadows:

- Choose lighting fixtures that illuminate spaces evenly instead of fixtures that direct light over a localized area (e.g., pot lights).
- Avoid placing objects between the light fixture and workstation that can block the light and cast shadows.
- Paint ceiling and walls in light colours that reflect light.
- Clean ceilings, walls, and light fixtures.
- During the design stage, consider the location of furniture and workstations relative to light fixtures. Keep lighting levels as evenly balanced as possible.
- Use task lighting (desk lamp) to increase the amount of light delivered to the desk surface.
- Adjust the screen brightness to match the general brightness of the room.

Glare

Glare can cause visual discomfort and decrease a person's ability to see.

Direct glare is caused by bright lights from poorly positioned light fixtures or daylight entering through windows and skylights. The source of the glare may be from direct view of the sun or

clouds or from reflections from adjacent buildings. Reflected glare can be caused by light reflecting off computer screens, shiny desk surfaces, and windows.

To reduce direct glare from daylight and electric lighting:

Workstation Layout

- Position the workstation so that light fixtures are not directly in front or overhead. Workstations should be positioned between rows of overhead lights.
- Position workstations at 90-degree angles to windows so that the employee does not face the window or have their back to a window.
- Reorient workstation and displays so that light fixtures that produce glare are not in direct field of view.
- Install moveable partition or partition walls to block light from exterior windows and overhead lights. Note: introducing screens to reduce glare may also reduce the availability of light.

Light Fixtures

- Remove or disable select light fixtures.
- Shield glare sources with louvers, diffusers, shades, or other guard devices.
- Use several small low-intensity light fixtures rather than one large high-intensity one.
- Use light fixtures that direct light upwards (indirect light fixtures).
- If task lighting is used, it should be positioned so that it does not cause direct glare.

Window Treatment

- Ensure windows have coverings, such as curtains, blinds, drapes, or awnings so that outdoor light levels can be controlled.
- Use low-transmittance tinted glass or apply tinted glass film to reduce daylight penetration.

To reduce reflected glare from daylight and electric lighting:

Surface Treatment

- Finishes of desk surfaces and office equipment (e.g., keyboard) should be kept matte where possible to reduce reflections.
- Apply flat/matte paint finishes on walls and ceiling surfaces instead of glossy, reflective paint finishes.

Workstation Layout

- Tilt computer monitor(s) slightly downwards to reduce reflection from overhead lights.
- Reposition computer displays and workstations to minimize reflections.
- Remove highly polished and shiny objects out of the field of view.

Light Fixtures

- Position light fixtures to reduce the amount of reflected light directed towards the eyes.

- Use indirect light or combination of direct and indirect lighting to reduce glare reflected from horizontal surfaces.

Contrast

Contrast is the difference in colour between an object and its background. Too little contrast can make objects difficult to distinguish from the background. For example, it may be challenging to make out print from the paper it is on or text from the background on computer screens. There should be good, but not excessive, contrast between the task and the background.

To correct for poor contrast:

- Adjust screen/character background. Use dark characters on a light background.
- Adjust monitor brightness and contrast controls to maximize character definition.
- Use contrasting colours for objects and the background (e.g., use ink pens rather than pencils).
- Paint stationary and parts of moving equipment in contrasting colours to improve visibility.

Light Flickering

Voltage fluctuations supplied to light sources can produce light flickering in office lighting which can cause headaches and eye strain/discomfort for some individuals. Flickering can occur due to the lamp source, age of the lamp, electrical malfunctions, lamp/ballast incompatibility, or improper operating environment.

To reduce or eliminate light flickering:

- Replace any flickering light bulbs.
- Report any malfunctioning light fixtures to your supervisor and local facilities group for repair.
- Where applicable, consider the use of magnetic ballasts versus electronic ballasts. Magnetic ballasts are more prone to flickering than electronic ballasts.
- If dimmer switches are available, ensure dimmer switches are functioning properly.
- Disconnect or relocate electrical equipment that are drawing heavy currents.

Blue Light

Exposure to artificial, blue-enriched lights in indoor office environments during daytime hours may strengthen circadian timing and promote other positive health effects. However, exposure to blue-enriched light during evening or night-time may cause sleep disturbance and other negative health effects.

To reduce the negative impacts of blue-enriched light:

- Avoid exposure to blue-enriched light during night-time if possible.
- Adjust the settings of backlit electronic devices and apps to reduce blue light from screens (e.g., laptops, tablets, monitors, mobile phones).

Light Sensitivity

Light sensitivity in individuals can be triggered by any type of light source, including LEDs, fluorescent, and even natural light. Factors that contribute to this condition include brightness, flickering, and colour (wavelength) of the light.

Strategies to reduce sensitivity to light sources in the workplace include:

- Rearranging the office layout so that light fixtures are outside the field of view. Orient workstation so that the light is further away or to the side.
- Choose light bulbs with lower brightness (lower lumen values).
- Ensure light fixtures have appropriate shielding (diffusers/covers, lenses, louvers) to diffuse light from the bulbs.
- If dimmer switches are available, adjust light levels to the employee's preference.
- Lower the brightness on computer screens and smartphones.
- Request some of the overhead light bulbs be removed in the vicinity of the workstation.
- Consider replacing light bulbs that produce a bright white hue (e.g., daylight bulbs) with ones that have a warm, yellow hue (e.g., soft white bulbs).
- When solar glare is not an issue, using natural daylight instead of electric lighting to illuminate indoor spaces.
- Use LED-lit devices, such as a smartphone, in a well-lit environment.

If you think you have light sensitivity, contact Health and Well-Being to discuss the possibility of a workplace accommodation.

6.0 ADDITIONAL RESOURCES

Environmental Health and Safety (University of Toronto): Office Ergonomics Website

Environmental Health and Safety (University of Toronto): Lighting Ergonomics - How to Improve Your Lighting Environment at Work

University of Toronto: Office Ergonomics Standard

7.0 REFERENCES

Canadian Centre for Occupational Health and Safety: Lighting Ergonomics Fact Sheets

CSA Group: CSA Z412-17 Office Ergonomics – An Application Standard for workplace Ergonomics

APPENDIX A

TYPICAL ILLUMINANCE LEVELS BASED ON TYPE OF ACTIVITY

Type of Activity	Illuminance Range (Lux)
Simple orientation for short temporary visits	50-100*
Working spaces where visual tasks are performed only occasionally	100-200*
Performance of computer tasks	75-300
Performance of visual tasks of high contrast or large size (e.g., reading printed materials of good quality)	200-500†
Performance of visual tasks of medium contrast or small size (e.g., reading medium-pencil handwriting, and poorly printed or reproduced material)	500-1000†
Performance of visual tasks of low contrast or very small size (e.g., reading handwriting in hard pencil on poor quality paper and very poorly reproduced material)	1000-2000†

General lighting throughout room, † Illumination on task

Reference: From Annex A, Table A.5 in CSA Z412-17: Office Ergonomics – An Application Standard for workplace Ergonomics

Note: The illuminance ranges listed above are intended to be used as general guidelines only and should not be interpreted as mandatory lighting requirements for University of Toronto office settings. Environmental and individual factors must be considered when determining the appropriate amount of illumination required for a particular task. In general, computer work requires lower overall light levels than paper-oriented desk work.