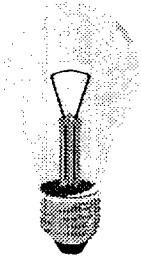


Just the Facts... **Lighting in the Office Environment**



Lighting is one of the major elements affecting efficiency, productivity and comfort in the workplace. Light intensity, expressed in lux, is the amount of light that falls on the work surface. Light intensity must be low enough for general comfort yet sufficiently high for visual tasks. Generally, room lighting should be no more than three times brighter or three times darker than the illumination on the task.

The use of video display terminal (VDT) screens in modern offices is a prime example of the need for effective illumination. The lighting in most office environments is too bright for optimal VDT screen viewing. The illumination may be reduced by removing two bulbs in four-bulb fluorescent fixtures, removing the bulbs in every other fixture, or turning off overhead lights altogether. Supplemental desk lighting is better than overhead lighting for reading a printed copy.

It is important to consider the needs of all workers and tasks in a work area when modifying illumination. This fact sheet addresses factors to consider when adjusting light to meet individual needs.

Visual System

The amount of light needed for maximum visual efficiency varies with the individual visual system. Factors such as pupil size, ability of the eyes to accommodate for nearness, and even the color of the eyes affect how objects are seen. These factors play an even more important role with aging. Even with correction, visual acuity declines with age as does resistance to glare and color discrimination. The pupil of the eye generally gets smaller with age, and therefore requires more illumination than that of younger individuals. Attention to room and task lighting can help improve acuity and prevent discomfort, annoyance, interference, and eye fatigue.

Direct vs. Indirect Lighting

Direct lighting is the light falling directly on a task. It is the most efficient type of illumination, but it tends to produce shadows and glare. Indirect lighting is light reflected off adjacent ceilings and walls. Indirect lighting produces less glare and is more comfortable to work under than direct lighting. However, since indirect lighting is reflected, more initial illumination is required to achieve the same illumination as direct lighting. Because of this, indirect lighting is less efficient and more costly than direct lighting.

Glare

Computers are often situated in work environments where there are potential sources of glare such as overhead lights or windows without curtains. Glare can interfere with vision and reduce productivity. Although identifying sources of glare may be easy, eliminating the sources is often more difficult. Sometimes the work space can be arranged to move the computer terminal away from the glare (e.g., arrange desks and VDT screens so they are oriented 90 degrees from light sources), or partitions can be added to remove the unwanted glare. Other work, such as reading print on glossy-paged books and journals, may produce glare problems for the worker.

Light Sources

An object will render different colors depending on the type of light source. Poor color rendering can distort color perception, increase eye fatigue, and decrease productivity. Fluorescent lamps and incandescent lamps provide good color rendering. Mercury vapor, metal halide, and low-pressure sodium lamps are energy-efficient sources, but distort color perception. The more efficient lamps do not provide the best quality of light. The hidden costs of eye fatigue, decreased productivity and decreased quality of work often justify the investment in higher quality lighting.

Ergonomics Program
U.S. Army Center for Health Promotion and Preventive Medicine
Aberdeen Proving Ground, MD 21010-5403
DSN 584-3928 or Commercial 410-436-3928
email: ergo@aeha1.apgea.army.mil

- ◆ **Illumination**
- ◆ **Glare**
- ◆ **Footcandles**

Common Tasks and Illumination Levels

◆ Normal Activity

For reading normal print and operating machines, 200-800 lux (20 to 80 footcandles) is normally sufficient. Greater light intensities are required if details are small, contrast is poor, or if the viewer is older or has limited vision.

◆ VDTs

The recommended illumination level for VDT work is from 200 to 500 lux (20 to 50 footcandles), but task lighting of 500 to 1500 lux may be needed when VDT work and paperwork tasks are combined. Levels of general illumination greater than 50 footcandles are not recommended because they produce glare and are expensive. The table presents recommended illumination levels for many tasks.

Suggested Solutions for Lighting-Related Problems

General work area illumination may be improved by:

- ◆ Adjusting general lighting to provide effective illumination for most workers in an area.
- ◆ Using a combination of ambient (general) and localized lighting.
- ◆ Using diffuse lighting.
- ◆ Replacing fluorescent bulbs regularly to reduce flicker.
- ◆ Examining the environment (walls, ceilings, floors, equipment) to see where light is reflected.
- ◆ Cleaning surfaces used to reflect light.

Office-based work using computers may be improved by:

- ◆ Increasing character size and/or screen contrast on computer monitors for better legibility.
- ◆ Preventing reflections and shadows by shielding the work area or rearranging the workstation.
- ◆ Having a "visual relief area" to look at away from the computer or desk to relax the eye muscles.
- ◆ Using antiglare screen filters or antireflective coatings on eyeglasses for computer users.
- ◆ Alternating tasks for computer users to allow for a variety of visual tasks.
- ◆ Cleaning the monitor screen regularly to remove dust particles which can reduce legibility.

References

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2. Godnig, E.C., *Computers & Visual Stress*, Abacus, Grand Rapids, Michigan, 1991.
3. Konz, S., *Work Design*, Publishing Horizons, Scottsdale, Arizona, 1995.
4. Technical Bulletin, Medical (TB MED) 506, *Occupational Vision*, U.S. Army Environmental Hygiene Agency, APG, Maryland, 1981.
5. Title 41, Code of Federal Regulations (CFR), Section 101-20.107, *Energy conservation*, U.S. Government Printing Office, Washington, DC, 1996.

Task Illumination: Federal Energy Conservation ¹ vs. Illumination Specialists' Recommendations ²		
Illumination Level (footcandles)	Federal Energy Conservation Lighting Recommendations by Task	Illumination Specialists Summary Lighting Recommendations by Task
1-5	Corridors, stairwells, walking surfaces, elevator-boarding areas	
6-10	Storage areas, nonwork areas	Auto parking areas, aisles, and hallways
11-20		Auditoriums, storage areas, stairways, swimming pools
21-30	Work areas (30" above floor)	Gymnasiums, assembly (average), loading dock, shipping preparation
31-50	Workstation surface (30" above floor)	Document preparation, average reading
51-100		Foods preparation, assembly and manufacturing (medium), workstation tabletop
101-200		Fine inspection, detailed work, assembly (fine), fine detail drafting/drawing
201-500		Machine work (fine detail), circuit assembly, very fine inspection

¹Title 41, CFR, Section 101-20.107, *Energy conservation*

²Composite of several references on illumination recommended in industry, recreation, and home.

NOTE: Higher illumination than 41 CFR 101-20.107 may be used if the recommended level presents a safety hazard. Permission of the building manager must be obtained prior to illumination upgrade.