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Measurement of Lighting Levels in the Work Place – *Canada Occupational Health and Safety Regulations,* Part VI - 928-1-IPG-039

OHS IPGs

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Effective Date: October 2009

1. Purpose

This Operations Program Directive (OPD) will assist Health and Safety Officers in the application of Part VI of the [Canada Occupational Health and Safety Regulations](#), "Lighting", published in the *Canada Gazette*, Part II, October 26, 1989.

2. Scope

This procedure should be used when measurements of lighting levels in work places are made by Labour Program personnel. This will ensure a uniform approach and yield consistent results.

3. Background

Briefly, these regulations:

- require the average lighting level to be computed using **four** measurements;
- include specific provisions for Video Display Terminal (VDT) work stations;
- include provisions dealing with lighting of airport aprons;
- use the unit LUX for all lighting levels; (10.76 lux =1 foot-candle).

4. Question

4.1 How should lighting level measurements be made?

5. Procedure

5.1 Instrument

At this time, the instrument generally in use for lighting level measurement by the Labour Program is the Optikon Hagner EC1 luxmeter. This is a digital readout instrument which is accurate to 5% according to its manufacturer. The instrument calibration must be verified annually by Labour Program's laboratory (the date of the last calibration is shown on the calibration sticker. If you have any questions concerning the calibration of the instrument, please call the Manager of the Laboratory at 613-990-8423) and the calibration sticker must be intact, showing that the calibration adjustment has not been tampered with.

Because the calibration procedure used by the laboratory is itself only accurate to 5%, readings obtained with the instrument can be as much as 10% off. To offset this potential error, 10% is added to results, where a minimum value is specified; 10% is subtracted where a maximum value is specified. For instance, if an average of 480 lux was obtained in an office where the **minimum**

requirement is 500 lux, a 10% error allowance, or 48 lux, would be **added** to the value of 480 lux, yielding a total of 528 lux, which is over the minimum acceptable value.

5.2 Technique

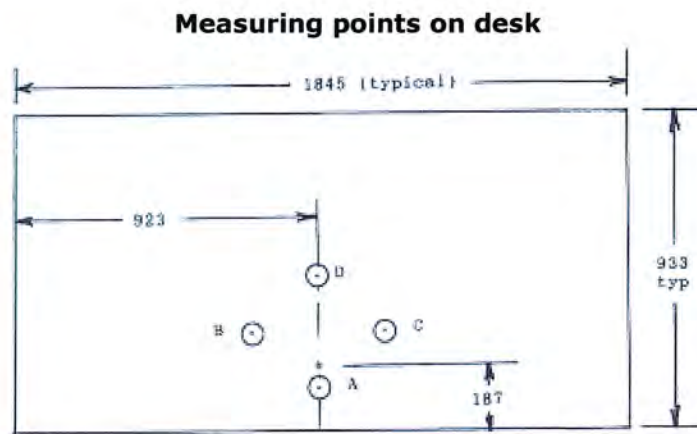
The range selector switch of the light meter must be set to the lowest range possible (the one giving the highest reading). This will ensure the most accurate reading within the capabilities of the instrument. When taking measurements, the light meter must be either laid down on the surface to be evaluated with the light sensor facing up or, in the case of area measurements, held horizontally with the light sensor facing up (unless otherwise noted). Also, when reading the meter, one must be careful not to shield the light sensitive cell: this would result in an artificially low reading (this might require the use of the "hold" button so the reading can be suspended and not affected by the reader's head). If measurements were being made in an evenly lighted area, four positions could be selected at random, but this is very seldom the case; for this reason, the four points (or sets of four points if necessary) should be carefully selected as explained previously so that the average will be representative of the lighting level.

5.3 Measurements

Section 6.3 of the Regulations outlines the requirements for measurements: **four** measurements are made at different points **representative** of the level of lighting at the work position or, in an area, at different points **representative** of the level of lighting, 1 m above the floor of the area; the sum of the four measurements is then divided by four. The word "representative" means that the selected measurement points are not anomalous. Selecting the four darkest points or the four brightest points for measurement will not yield a representative value. The points must be selected so that based on the HSO's observations the average will represent the lighting level at the site being evaluated. The following paragraphs detail the procedures to be used in various situations. Remember to always take into account the 10% potential error on the readings.

5.3.1 Offices

The template below, is enclosed with the emergency kit and should be used for measuring illuminance on desks (this is adapted from the *Illuminating Engineering Society of North America* documentation). The instructions for its use are printed on it.



Coordinates (x, y) of measurement points
Relative to task center (+)

Point	x	y
A	0	-110
B	-152	42
C	152	42
D	0	195

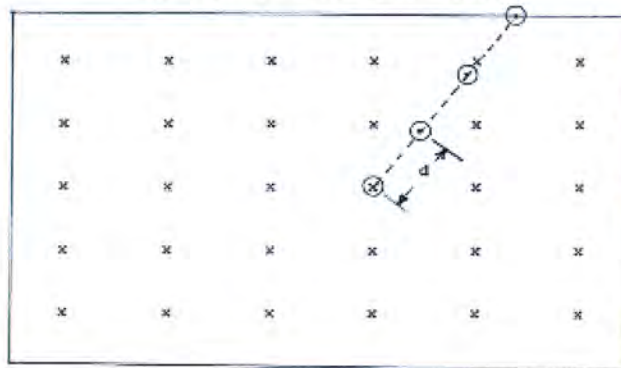
5.3.2 Industrial areas

The same template used for office desks should be used, but only for tables, benches and similar structures. In the case of specific visual tasks, take measurements directly at task, adjusting the grid to the size of the task.

5.3.3 Indoor areas support spaces

In the case of indoor areas support spaces and depending on size, the number of sets of four measurements could have to be increased, being careful to get a good sampling of values, both low and high. The suggested method is to use a linear grid of four equally spaced points on a straight line, separated by 3 m or less, starting under a luminaire and ending at the wall. When measuring, the luxmeter must be held horizontally, 1 m above the ground. If the room is large or irregular shaped, it might be necessary to repeat this procedure a number of times. The same technique can be used for stairs, along walking pathways and for working areas of support spaces.

Indoor area measurement



x = luminaires

d = distance between each measurement point; this distance should be equal to 3 m or less

o = measurement point

Measuring lighting levels in an area:

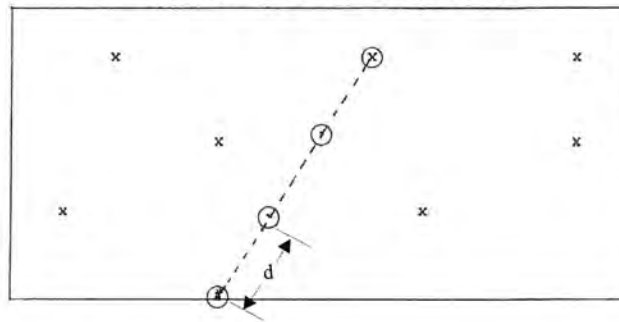
A line measuring up to 9 m (a maximum of 3 m between each point) is laid starting under a luminaire and ending at the wall; it is then divided into three equal lengths and measurements are made at both ends and at each of the two intermediate points. In the case of a large or irregularly shaped room, a number of such lines should be laid to obtain a fair average for the area.

5.3.4 Outdoor areas

In the case of outdoor areas, a similar technique to the one used for indoor areas can be used except that the starting point of the grid would be at the observed darkest point in the area and the end point at the brightest point in the area (under a luminaire), each point being separated by

an equal distance of at least 3 m. Again, for large areas or areas of uneven shapes, a number of sets of four measurements each might have to be laid down to obtain a fair average.

Outdoor area measurement



dotted line: limit of area

x = lamps

d = distance between each measurement point; this distance should be 3 m or more

o = measurement point

= darkest point in area; this can generally be found by casual inspection

Measuring lighting levels in an outdoor area:

A line measuring at least 9 m (3 m or more between each point) is laid starting under a lamp (the brightest point) and ending at the darkest point of the area; this line is then divided in three equal segments and measurements are made at each end and at each of the two intermediate points. In the case of a large or irregularly shaped area (or when lighting is very uneven), a number of such lines should be laid to obtain a fair average for the area.

5.3.5 Airport aprons

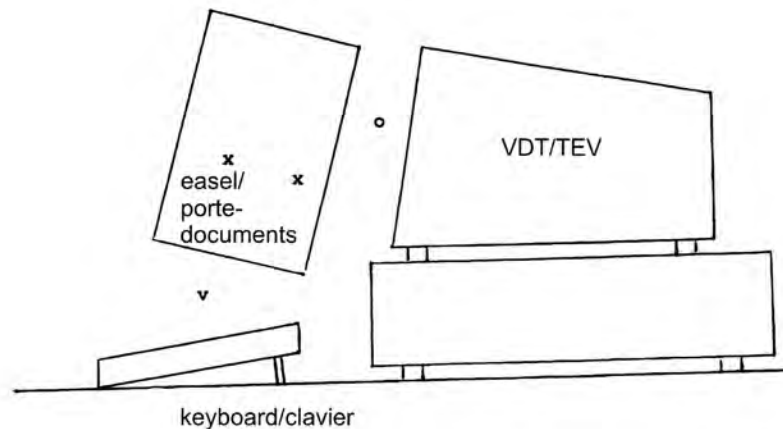
In the case of airport aprons, the technique used is the same as outlined in section 5.3.4, *Outdoor areas*; for aircraft stands at task position, use the technique described in section 5.3.2, *Industrial areas*.

5.4 VDT work stations

The regulations contain special requirements for VDT work stations: these are outlined in section 6.7 and in Schedule IV. It must be noted that the levels contained in this schedule are **maximum** levels, contrary to the other schedules which prescribe minimum levels. The distinction between task positions 1.(a) and 1.(b) is as follows: *data entry and retrieval*, 1.(a), is interactive work where the operator alternately looks at the screen and at the document, while *data entry only*, 1.(b), is work where the operator reads from a document without ever looking at the screen.

When taking measurements around a VDT terminal, the recommended procedure is to take two measurements at the keyboard position, 20 cm apart, and two others close to the screen, 10 cm apart, the luxmeter being held horizontally in all cases; these four measurements should then be averaged to obtain the illuminance value at the VDT station. Two measurements at the document position, 10 cm apart, with the luxmeter laid down on the document, should then be taken to ascertain the illuminance level on the document. These two readings should then be averaged. It must be noted that sub-section 6.7(3) of the Regulations specifies that where VDT work requires the reading of a document, the level of lighting on the document must be at least 500 lux. This means that the luxmeter must be laid down **on** the document, whether the document lies on a desk or is angled on an easel.

VDT work station measurement



o, v, x = measurement points

Measuring lighting levels at a VDT work station:

Two measurements, 10 cm apart, are made immediately in front of the VDT screen (point "o") and two other measurements, 20 cm apart, are made above the keyboard (point "v"); these four measurements are then averaged and the result must be less than the **maximum** specified in Schedule IV.

Where the VDT work requires the reading of a document, two other measurements are made on the document or the document support as the case may be (the luxmeter lies on the document or easel); the average of these two measurements must be a **minimum** of 500 lux.

6. Other requirements

6.1 Minimum levels

As detailed in Section 6.11 of the Regulations, the level of lighting at any point at a task position shall be not less than one-third of the level prescribed for this task position. Some exceptions are outlined however such as:

- in parking areas, lobbies and atria, the minimum level is one-tenth of the prescribed level;
- at VDT work stations, the minimum level is one-tenth of the prescribed level;
- at task positions on airport aprons and on operational aircraft stands, the minimum levels are one-quarter of the prescribed levels;
- in buildings where construction begins after October 31, 1990, the minimum level of emergency lighting shall be not less than 0.25 lux on emergency exit routes (see 6.10(1) of the Regulations for exact wording).

6.2 Reflection glare

Subsection 6.7 (2) of the Regulations details requirements on reflection glare at VDT work stations. There is no simple objective way to evaluate this aspect. However, if this question comes up, some possible solutions are:

- change orientation or position of work station;
- sometimes, offensive fixtures can be turned off;
- use anti-glare screens, hoods, etc;
- install drapes, partitions, etc.

6.3 Testing of emergency lighting

The testing requirements are detailed in section 6.10 of the Regulations for battery-powered systems and in standards CSA C282 for internal combustion engine powered systems. In all cases, testing records must be kept for two years after a test.

7. Additional questions

If questions arise, you can get in touch with the Technical Services Unit, Occupational Health and Safety Division at 819-953-0218.

Caroline Cyr
Director General
Program Development and Guidance Directorate
HRSDC – Labour Program

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