

Navigation ☰ 🔍

[Home](#)

Site pages

Current course

[Food Processing Plant Design & Layout](#)

- Participants
 - General
 - Module- 1. Introduction of food plant design and ...
 - Module- 2. Location and site selection for food pl...
 - Module- 3. Food plant size, utilities and services
 - [Lesson 5. Food plant size and utilities](#)
 - [Lesson 6.Illumination and Ventilation](#)
 - Module- 4. Food plant layout Introduction, Plannin...
 - Module- 5. Symbols used for food plant design and ...
 - Module- 6. Food processing enterprise and engineer...
 - Module- 7. Process scheduling and operation
 - Module 8. Building materials and construction
 - 19 April - 25 April
 - 26 April - 2 May

[Courses](#)

Lesson 6.Illumination and Ventilation

6.1 Illumination of the Processing Facility

Pride in the workplace is easier to maintain in a well-illuminated plant than in a dark and dull facility. Working in an environment that is perceived to be clean promotes neat and tidy work habits. Good illumination enhances the operation of a well-run plant and promotes efficiency and safe working conditions.

Good lighting is an easy goal to reach and a quick fix to eliminate dark corners and unsafe work areas. The range of lighting hardware makes it possible to have a well-lighted plant. Industry recognizes standards that should be met or exceeded.

When a lighting system is designed, the following points should be considered

- Distribution pattern of the light and suitability in the area involved
- Illumination output of the light hardware
- Possibility that larger lamps can be used in the same fitting when more light is required
- Design and construction of the lamp and its fitting
- Change in lamp efficiency over time and ease of periodic servicing, cleaning, and replacement
- System cost

Light is measured in luminous intensity as candela (cd) in SI units.

Table 1 Recommended Levels of Illumination

Offices	Illumination (candela)
Designing, detailed drafting	200
Bookkeeping, auditing, tabulating, rough drafting	150
Regular office work, filing, index references, mail sorting	100
Reading or transcribing handwriting in ink or medium pencil	70

Reading high-contrast or well-printed material	30
Corridors, elevators, stairways	20

6.1.2 Light intensity and application

In any work area, the light should be diffuse and uniformly constant. For the most efficient use of available light, the ceiling should have a minimum reflectance of 75% and the sidewalls 50 to 60%. The floor should be 20% reflective. To prevent eyestrain, glare should be avoided. The amount of light reflected off any surface is affected by the smoothness of the surface. When the surface is rough, the reflection will be scattered, and the reflected light will diffuse. When the paint surface is smooth, irregularities in the painted surface can cause glare. The color of the paint will also affect the amount of light reflected.

Because walls are normally fairly smooth, color is the dominant factor in determining reflectance and illumination. Light colors reflect high proportions of light, while dark colors absorb a lot of light. Table 2 provides reflection values for different colors of paint. There is obvious variation between shades of the same color. Human perception of color is influenced by the color of the light that illuminates it. When the dominant color in an area is cream, ivory or tan, white fluorescent lighting will be best. If the dominant colors are blue or green, the blue-type fluorescent lights will work best.

Table 2 Light Reflection by Different Colors of Paint

Color	Reflection (%)	Color	Reflection (%)
White gloss	84	Light blue	54
Flat white	82	Medium green	52
White, eggshell	81	Maple wood finish	42
Ivory white	79	Medium blue	35
Silver gray	75	Dark gray	30
Yellow	75	Oak wood finish	17
Cream	74	Walnut wood finish	16
Pink	72	Dark red	13
Light buff	70	Mahogany wood finish	12
Ivory tan	67	Dark brown	10

Medium yellow	65	Dark blue	8
Light green	65	Dark green	7
Medium buff	65	Black	5
Medium gray	58		

6.1.3 Types of lamps

Many types of lamps are used in processing areas. In most cases, fluorescent lamps are favored because they have about 2.5 times the efficiency of incandescent lamps. They also give soft diffused light without glare. Fluorescent lamps are best suited in areas where the lamp stays on for long periods of time. In places where lamps are frequently switched on and off, fluorescent light should not be used. Frequent on and off service not only results in a short lifespan of the lighting element but places an extra load on the starting transformer. Fluorescent lamps can be used for about 2500 to 4000 h before they need to be replaced. Incandescent lamps must be replaced every 800 to 1000 h.

Most installations use fluorescent lighting in all areas possible. In some high moisture areas, including cold rooms and where explosive vapors may be present, incandescent light fittings with vapor-proof fixtures are required. In the cereal industry, cereal dust can be very explosive when mixed with the right amount of air. In these cases, light bulbs and all fittings are completely enclosed and water tight.

At loading docks, large warehouses and outside areas, where extensive coverage is required, mercury vapor lamps are used. Mercury vapor lamps are several times more efficient than fluorescent lighting.

Incandescent lamps radiate more long-wave radiation in the yellow and red ranges, while fluorescent lighting is bluer. Incandescent lamps produce light and heat. This is an obvious drawback in cold storage areas. If fluorescent lighting is used in cold rooms, the tubes must be rated to operate at temperatures below 5°C.

The installation cost for fluorescent lighting is considerably greater than the cost for incandescent lighting. The energy savings will pay for this additional expense over time. All light bulbs should be replaced at regular intervals. Replacing them only if they are broken means that there will be one or two lights out at any given time. Lights have an average lifespan and should be replaced before they break.

6.2 Ventilation of the Processing Facility

Ventilation is the supply of fresh, conditioned air to replace unwanted air. Conditioning can include alteration of moisture content, change of temperature, and filtering to remove particulates and organisms.

Within the processing area, ventilation will remove obnoxious odors, moisture, and heat and replace it with air that is free from contaminants and air that will increase the comfort level of workers. The amount of air is calculated as a replacement volume. Depending upon the production processes, the air can be replaced from 6 to 20 times per hour. It is also advisable to keep the processing area under a slight positive pressure. This will ensure that processing area air flows out when a door is opened.

Special air is required in areas where baby formula is handled or where aseptic operations take place. In these cases, air will be filtered through special filters that will remove organisms. The processing area must be under positive pressure at all times so that no organisms can enter from adjacent processing areas.

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