Lighting in Food Premises

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CERTIFICATION

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eliminate the hazard - reduce the risk

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Lighting in Food Premises

A White Paper, by HACCP International

Introduction

Food-safe lighting is essential in any food-related business. Not only does it keep your products and customers safe, but it also helps maintain hygiene standards.

Poor lighting can negatively impact worker productivity and have an impact on food safety, by inhibiting good cleaning practices. In addition, unsuitable light fixtures can be a source of contamination. It is therefore critical to food safety to choose lighting solutions that will provide the right amount of illumination, as well as being easy-to-clean and free from characteristics that could cause foreign body contamination like loose screws, insect bodies and pieces of glass.

This white paper provides an introduction to lighting for the food industry, including manufacturing facilities, commercial kitchens and hospitality venues. It explains the key characteristics of food-safe lighting and includes information about choosing the right fixtures for your business.

About HACCP International

HACCP International is an independent organisation dedicated to food safety. HACCP International is a third party provider of certification services.

HACCP International's mission is 'to promote best practice and innovation in food and related industries through a product certification programme designed for non-food products and services used in the food industry'.

HACCP International operates an assessment and certification scheme for equipment, materials and services used within the food industry. Certification is offered for products or services that make a contribution to food safety and can be used by the food industry without risking the safety of food or the integrity of a food facility's HACCP-based food safety management system.

Products are evaluated by performing a risk-based hazard analysis based on the principles of HACCP as described in the Codex Alimentarius of the World Health Organisation. The *HACCP International Food Safety Standard FOOD SAFE PRODUCTS and SERVICES for FOOD BUSINESSES* describes this process and defines requirements for certification.

Terminology

Every food facility requires a range of different light sources, including indoor lighting, outdoor lighting, natural lighting, cold storage lighting and emergency lighting. The lighting industry uses a range of specialised terminology. What follows is a brief introduction to some lighting-related terms, that will be used throughout this whitepaper.

Luminaire

A luminaire is a complete lighting unit that contains all the necessary parts to produce light, including the light source, reflector, diffuser and power supply.

Luminaires are usually designed to provide a specific distribution of light, depending on the needs of the space they are illuminating. For example, some luminaires provide a wide beam of light that is ideal for general lighting, while others provide a narrow beam that is ideal for task lighting.

Luminaires can be further categorized based on their installation method, their shape, and their function. Some common types of luminaires include recessed lights, track lights, high bays, low bays, pendant lights, and wall sconces.

Lumens, Luminous Flux, Lux, Foot Candles

Lumens is a unit of measurement that describes the amount of light emitted by a given source. A lumen value is used to describe the brightness of light bulbs and LEDs.

A lumen is equal to the amount of light produced by one candle in an area where the candle can be seen from a distance of one foot. The term ‘lumen’ comes from the Latin word for ‘light.’ Lumens can also be used to measure the amount of light that is visible to the human eye. For example, a 100-watt light bulb produces about 1,600 lumens, while an LED light might produce 800 lumens.

Luminous Flux is the total amount of light coming from a source, expressed in lumens. Lumens are a useful way to compare the brightness of different light sources. However, it is important to note that the number of lumens alone does not determine how well a light source will illuminate an area. The distribution of the light and the shape of the luminaire also affect how well an area can be lit by a light source.

Lux is the unit used to measure the amount of light in a particular work area. Put another way, lux is the unit of illuminance, which is the amount of luminous flux in a given area, expressed in lumens per square meter.

Foot Candles are equivalent to lux, in imperial units. One foot-candle is the amount of light needed to saturate a one-foot square of surface with one lumen of light.

Wattage

The wattage of a luminaire is the maximum amount of energy that it can use, measured in watts. The higher the wattage, the more energy is used. Most household luminaires have a wattage of 40 watts or less. However, industrial applications require more powerful luminaires. Luminaires with a higher wattage consume more energy and emit more heat.

The wattage of a luminaire does not necessarily relate to its light output. A 100 watt luminaire, for example can produce more light than a 60 watt luminaire if it is more efficient. The efficiency of a luminaire is the ratio of light output, in lumens, to the power input in watts. A more efficient luminaire produces more light per watt.

Useful Life

Useful Life describes the useful life of a population of a given model of LED lamp or luminaire, described in LxBy. The LxBy of the product describes the median life in hours for which a certain percentage of the LEDs are still able to provide a certain percentage of their initial output. For example, a model with a useful life of 50,000 h, L80 B50 means that after 50,000 hours of operation, 50 percent of the luminaires will still have an output of at least 80% of their initial output.

Lamps

In lighting terminology, a lamp is the source of light within a luminaire, such as a bulb or fluorescent tube. Lamps may be designated with different letter codes, which correspond to their shape. For example, a 'P' lamp is pear-shaped, a 'F' lamp is flame shaped, such as would be used for a chandelier, a 'R' lamp has a reflective coating so it emits light in one direction.

Incandescent lamps are traditional 'light bulbs' which contain a wire filament that is heated by electric current until it glows. They are an inefficient way to produce light, converting less than 5% of the energy used to visible light, with the remainder being lost as heat. They also have a relatively short lifespan compared to other lamps.

LED lamps produce light when electricity passes through a semi-conductor, which is a light emitting diode (LED). They are more compact and efficient than incandescent bulbs and they have a much longer lifespan. LED lamps can emit light of different colours. They come in various sizes and shapes, and may be permanently integrated in a luminaire, so that they cannot be 'replaced' like a traditional lamp. They are also available in a tube-shaped configuration for retro-fitting into fluorescent lights.

Halogen lamps are a type of incandescent lamp that contains an inert halogen gas like iodide or bromine. They last longer and can be more efficient than traditional incandescent lamps, emitting more light per watt. Halogen lamps were used for indoor and outdoor floodlighting but are increasingly being replaced with LEDs which have a longer lifespan and can be more efficient.

Halide and metal halide lamps generate light by passing an electric current through a gaseous mixture of vaporized mercury and metal halides using a process called arc discharge.

Metal halide lamps are more expensive than traditional incandescent bulbs, but last significantly longer and use less energy.

Metal halide lamps are commonly used in outdoor lighting applications, such as streetlights, parking lots and stadiums. In food facilities they would traditionally be found in areas with high ceilings, such as warehouses.

Fluorescent lamps emit light when phosphors in the lamp are activated by an electric current, emitting energy. The energy is converted to light in a fluorescence process. They are efficient and produce very little heat compared to incandescent lamps.

IP Ratings

IP stands for ingress protection. An IP rating is a code that indicates how well a luminaire is protected against the ingress of dust and water. The first digit corresponds to the level of protection against solids, such as dust, and the second digit corresponds to the level of protection against liquids.

The higher the digits, the better the protection. For example, an IP65 rating means that the luminaire is completely protected against dust, and is also protected against low-pressure jets of water from all directions. In contrast, an IP20 rating means virtually no protection against dusts or liquids.

Luminaire Styles in Food Facilities

Highbay lights ('highbays') are mounted close to the ceiling in areas with high ceilings such as in warehouses and large processing areas. They are mounted using a pendant chain or cable or are fixed directly to a ceiling structure or beam.

Lowbay lights ('lowbays'), like highbays, are used to provide light at floor working height from a ceiling. However, lowbays are used in areas with lower ceilings than highbays, or are suspended so that they are closer to the working area.

Batten-style luminaires ('battens') have a long rectangular shape and were traditionally used to house fluorescent lamps but are now also used for LED luminaires. They can be surface mounted, recessed or suspended on a chain or cable.

Colour Rending Index (CRI) and Colour Temperature

The **Colour Rendering Index,** or CRI, is a numerical scale that measures how accurately a light source renders colours. For example, sunlight has a CRI of 100, while incandescent bulbs have a CRI of around 27-28. The higher the number, the more accurate colours will appear under that light source.

Colour temperature is a measure of the coolness or warmness of a light source, expressed in Kelvins (K), for lamps that create light using thermal radiation, such as incandescent bulbs.

Correlated colour temperature (CCT) is used for lamps that emit light using processes other than thermal radiation, such as fluorescent lights and LEDs. Like colour temperature, the CCT is also expressed in Kelvin, with higher numbers corresponding to cool colours and lower numbers corresponding to warm colours.

Requirements for Lighting in Food Premises

A food facility has many different areas, each with their own lighting needs. For example, a food manufacturing facility has exterior areas, parking lots, staff comfort areas, warehouses, cold storage, production areas, packing halls and dispatch docks. A food service restaurant has kitchen areas, loading dock areas, cold storage, dining areas and more. A food retail outlet has cold and ambient display areas for customers, as well as receiving and storage areas.

In each area, the luminaires and lamps chosen need to meet requirements for their illuminance, ability to be cleaned, colour temperature, energy consumption, ingress protection, breakage resistance, and – for dining areas – design and aesthetic requirements as well.

Illuminance Requirements

Adequate lighting is important in food processing and food preparation areas, to ensure a safe and comfortable environment for staff and to ensure tasks like sorting, cleaning and preparing food can be conducted effectively.

In areas where workers perform hazardous and difficult processes, such as when using knives, good lighting without glare can assist in minimising accidents. For cleaning tasks, adequate lighting is critical; cleaning operations must be verified visually, which means that poor lighting could be a hindrance to the sanitation of food premises.

For exterior lighting, the correct level of illuminance is needed for worker safety and security, by properly illuminating roads, paths and pedestrian routes outside buildings.

The comfort of workers is also a consideration with illuminance levels. Lighting should be visually comfortable and free from glare to allow workers to complete tasks without straining their eyes or having to adopt awkward postures.

In addition to ensuring worker comfortability, the quality of lighting also has a role in determining the productivity of workers. Lighting has been shown to improve workers' output as well as create flexibility and allow adaptiveness for workers when performing tasks[i]. The colour of the light source can also affect the emotions and the mood of workers[ii].

> LIGHTING IN FOOD PROCESSING AND HANDLING AREAS AND AT INSPECTION STATIONS SHALL BE OF APPROPRIATE INTENSITY TO ENABLE THE STAFF TO CARRY OUT THEIR TASKS EFFICIENTLY AND EFFECTIVELY.
>
> *SQF Food Safety Code 11.2.5.1*

The appropriate level of illuminance depends on the nature of tasks that will be performed in a given area. For example, product inspections require a higher level of illuminance while storage areas may need less. For an even light distribution, luminaires need to be evenly distributed in a space and chosen to minimise glare.

Recommendations and Requirements

There are expectations for light levels in most food safety standards and many government food regulations. Generally speaking, they state that the level of light must be adequate so that workers can do their tasks effectively and safely. However, most standards and regulations do not specify numerical values.

For example, the owners of the SQF food safety and quality codes, the Food Marketing Institute, *require* that lighting be appropriate, but *recommend* that food processing and food handling areas are illuminated to at least 200 lux. Inspection areas require higher illumination, so a minimum of 500 lux is recommended by SQF[iii] for such areas.

The British Retail Consortium Global Standards (BRCGS) recommends much higher levels of illuminance than SQF and suggest that 200 lux is suitable only for areas where there is little need for perception of detail such as foyers and entrance halls. They recommend that food production areas and other areas that require perception of detail, such as laboratories, be provided with an illuminance of 500 lux. For visual inspection tasks and quality control tasks, the BRC recommends an illuminance of 750 lux[iv].

The United States Food and Drug Administration require that there is ‘adequate’ lighting in their Code of Federal Regulations. They recommend minimum lighting intensities for each of the three main food premises activities, as follows: walk-in and dry storage areas should have at least 108 lux at a distance of 75 centimetres above the floor; handwashing areas should have at least 215 lux; high risk areas and areas where food is handled should have at least 540 lux[v].

> THERE MUST BE ADEQUATE LIGHTING IN PROCESSING AREAS, CLEANING AREAS, STORAGE AREAS. THERE MUST ALSO BE ADEQUATE LIGHTING IN HAND-WASHING AND TOILET AREAS AND IN DRESSING AND LOCKER ROOMS.
>
> *US FDA Code of Federal Regulations §117.20(B)(5)*

Away from production and preparation areas there are different requirements for illumination. For example, dining areas are usually less-brightly illuminated than preparation areas, to provide comfort and ambience to diners.

Warehouses with tall racking need lights mounted very high on the ceiling, so that the light is not blocked by racks and to avoid shadows at working height.

Exterior lighting needs to be powerful in order to illuminate areas like car parks and fences. Areas that are not adequately illuminated at night can pose a security risk to the facility, workers and customers.

How to Obtain the Correct Amount of Illumination

To ensure an adequate level of light in a given area, there is no off-the-shelf formula for choosing the correct number of luminaires and/or the appropriate wattages or lumen output.

A range of factors influences the illuminance in a work space, including the number of luminaires installed, their height above the working area, the shape and orientation of the lamps, the colour of the walls and any other reflective surfaces, the presence of corners or shadowing by equipment and the amount of natural light in the area.

The selection of appropriate luminaires must therefore be done on a case-by-case basis for each area. A properly qualified lighting specialist should be consulted to design a lighting set up to meet the needs of the food business.

Note also that the amount of light emitted by a lamp decreases over time, so care must be taken with lamp selection for luminaries that are difficult to reach, such as highbays.

Hygiene Characteristics of Luminaires

Food premises must be kept clean and sanitary at all times. Therefore all areas where there is exposed food must be fitted with equipment and fixtures, including luminaires, that can be cleaned easily.

When choosing a luminaire for a food handling area, it is critical that the area's typical cleaning regime is considered. Some luminaires and materials will degrade quickly if subject to frequent cleaning or intense cleaning regimes.

Luminaires for food handling areas must be of a hygienic design so that stay cleaner for longer and are easier to clean when required. The principles of hygienic design address both the materials of composition and the shape of a luminaire.

A hygienic luminaire is made from non-absorbing, moisture-proof, corrosion resistant materials. Corroded parts and moist or damp areas can allow the growth of microorganisms. Corrosion such as rust can also protect bacteria within its porous structure, and so prevent effective cleaning, which is why corrosion-resistant materials are a requirement.

The surfaces and exterior casing of a hygienically designed luminaire are smooth and free from joints, cracks and pits.

Internal corners must be of a large radius; small radius internal corners allow dust, dirt, grease and food debris to accumulate and it is difficult to remove them from such corners.

Some luminaries will be used in areas that are dry and are not usually cleaned with water. Such luminaries need to be able to be cleaned easily by wiping over with a hand in a cloth. Or, for high-bay luminaires in dry, non-greasy environments, by brushing with a hand-held brush.

For areas that are wet or that are cleaned using water, luminaires need to have an appropriate level of protection against ingress of water, as measured with their ingress protection (IP) rating. Luminaires with suitable water ingress protection features can be thoroughly cleaned with water without causing an electrical hazard or damaging the luminaire or lamps.

> LIGHT FITTINGS THAT ARE DESIGNED TO BE INSTALLED IN WET OR HIGH-RISK FOOD PRODUCTION AREAS SHOULD BE ABLE TO BE CLEANED BY BEING WIPED OVER WITH A CLOTH, AT A MINIMUM, OR BY WASHING. THEY SHOULD HAVE SMOOTH SURFACES, SEALED JOINTS AND SEAMS, LARGE RADII INTERNAL CORNERS AND SMOOTH FASTENERS.
>
> *HACCP International's Lighting Evaluation Checklist (Extract)*[1]

Installation methods also affect the hygiene characteristics of lights. For example, some luminaires can be installed by recessing them into a ceiling, so the light surface is flush with the ceiling. This protects the light from build-up of dust and debris and simplifies cleaning.

Low bay lights that are suspended from the ceiling can create catch points for dust and debris. If lowbays are suspended it is best practice to hang them using high-grade stainless steel cable rather than chain – cable is easier to clean. It is also best to choose lowbays with sloped top surfaces, which will collect less dust and be easier to keep clean.

[1] For more information about HACCP International's evaluation process for lights, email info@haccp-international.com

Luminaires that are to be wall-mounted or ceiling-mounted should have their rear or top surfaces and edges shaped so that it is possible for them to be completely sealed to the surface. Curved lips, flanges and steps around the edges of such luminaires can prevent thorough cleaning of nearby parts of the ceiling or wall and should be avoided. Sealing the light fixture to the wall or ceiling prevents insects from getting behind the fixture, and from accessing sensitive production areas through voids or wire inlet holes in ceilings or walls.

Hygienically designed luminaires are free of horizontal surfaces or 'catch areas' that can trap and hold dust, debris, insects, insect webbing and bird nests.

Luminaires for high-ceilinged environments like warehouses should have smooth surfaces, be free from horizontal surfaces that trap and retain dust and should be of a design such that they can be wiped or brushed free of dirt, grime and cobwebs. Luminaires with exposed heat-radiating fins that are very deep or very narrowly spaced should be avoided as narrow and deep fins are difficult to brush clean.

Colour Qualities

The colour rendering ability of a light source is important in food retail environments because it helps to ensure that food looks appetizing and fresh. Light that provides optimal colour rendering can make fruits and vegetables look vibrant and colourful, while poor colour rendering can make them look dull and unappetizing.

Studies[vi] have shown that pre-packaged food products can appear less attractive and less appetising in colder light compared to when displayed in warm light.

In food processing applications, lighting that provides good colour rendering assists employees to assess the quality of meat, fish, and poultry products and allows then to identify defects more easily. Light sources that provide output close to the colour of natural light may improve workers' moods and enhance circadian rhythms, which can assist with productivity and workplace satisfaction. The colour of the light source can also affect the emotions[vii].

Warm-coloured lights are used to provide a cosier ambience for restaurants and other hospitality venues, while back-of-house and industrial settings benefit from cool-coloured lights which are better for productivity[viii].

Some food products can have their quality negatively affected by exposure to the small amount of ultraviolet (UV) radiation that is emitted by some lamps. Fresh meat may become discoloured after exposure to such lamps because ultraviolet radiation encourages metmyoglobin formation[ix]. Metmyoglobin is brown and meat consumers relate the presence of brown colour in meat to a loss of freshness. Light-induced discolouration can be avoided by using low-UV, colour-balanced lamps, fluorescent lamps with UV filters, or LED lamps which are naturally UV-free.

Ingress Protection

Various locations in food premises have different requirements for the waterproof characteristics of luminaires, which also need to be protected from ingress of dust, grease droplets and other solids.

Exterior lights and lights for areas that are very dusty, dirty or wet have more stringent requirements for ingress protection. Ingress protection is measured by luminaire manufacturers and reported as an IP rating.

When selecting a luminaire, the IP rating should reflect both the usual operating environment and also any cleaning activities that will affect the luminaire.

Food facilities with hazardous dust issues or that contain flammable materials have special requirements for all electrical equipment, which needs to be chosen and installed to minimise the risk of dust explosion and other explosion events. Luminaires likewise must be carefully selected and installed in such facilities.

Breakage Protection

Protection from accidental breakage and vandalism is a consideration for lights in some areas of food premises, such as in areas that are accessed by members of the public, and areas where heavy machinery operates.

Breakages can be costly as well as potentially creating broken parts that can become hazards in food handling areas.

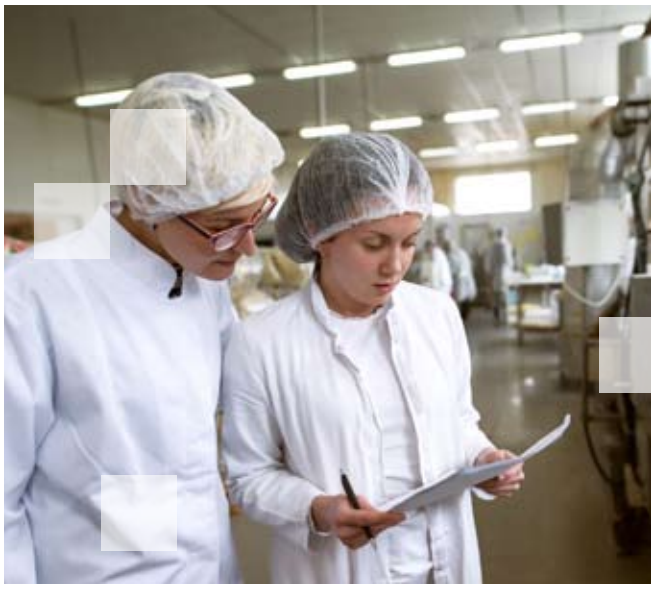
Robust lights that are fitted with impact-protection features, as well as fragment retention features, are a requirement in areas where breakage can easily occur. To reduce the risk of food contamination, most food factories have a no-glass policy.

Physical Contamination Hazards

Luminaries and lamps can both be sources of physical contaminants in food handling areas.

Physical contaminants are small pieces of hard plastic, glass, wires, clips, screws, rivets and other items that can come loose from luminaires during normal use or when damaged.

In areas where there is exposed food, sources of physical contamination must be minimised, and any potential hazards must be properly controlled.



Areas with exposed food include commercial kitchens, food production areas, preparation areas, packing areas, and filling stations. In these areas, luminaires must be designed and installed so that they do not become a source of physical contaminants that could get into food and cause injury to consumers.

In these areas, luminaires must not have any small parts or fasteners that could come loose or be lost during maintenance activities. Screws, especially screws on downward-facing surfaces, wires, gasket-plugs, small brackets and small clips should all be absent. Where clips are used to retain covers of diffusers, they should be large, easily cleanable and made from corrosion-resistant metal.

Cases, covers and diffusers should be made from material that is resistant to becoming brittle over time. Covers, diffusers and any exposed lamps must be shatter-resistant or have suitable fragment-retention properties.

> FOOD PRODUCTS AND PROCESSING AREAS MUT BE PROTECTED FROM CONTAMINATION FROM BREAKAGE OF LIGHT BULBS AND OTHER FIXTURES
>
> *FDA Code of Federal Regulations §117.20(B)(5)*

In other areas of food facilities, where food is not exposed, but is packaged, stored or protected inside pipework or machinery, it is good practice to also install luminaries that are free from physical contamination hazards and designed so that breakage does not contaminate the area.

The British Retail Consortium[x], a food safety standards owner, recommends that food businesses have a whole-of-site policy to always use ‘fragment retention lamps’ - also known as shatterproof lamps. They recommend that retro-fitted LED-replacements for fluorescent tube lamps comply with Class A of the IEC 61549 Standard for Miscellaneous Lamps to prevent contamination events. Fragment retention LED tubes have a single black band on the lamp[xi] to denote their fragment retention status. It is also possible to obtain fragment retention-optimised (‘shatterproof’) lamps for use in high bay luminaries.

Food businesses that are using such lamps or exposed fragment retention tubes should keep documentation on file to show auditors and inspectors that they are shatterproof.

Fragment retention tubes or lamps that are placed inside a covered or sealed luminaire, or in areas that have high operating temperatures need a higher heat rating than lamps for uncovered installations. This is because some classes of shatter-proofing are not suitable for hot areas, including inside sealed luminaires. It is important to check that a lamp is suitable for higher operating temperatures before purchase or installation.

How Shatterproofing Works

Shatterproofing, or fragment retention systems, work by retaining broken glass if a lamp ('bulb') is damaged. This is achieved by applying a polymer coating to the lamp, which sticks to the brittle material. The coating retains small pieces and prevents them from shattering outwards from the point of impact if the lamp is broken.

IEC 61549 Standard for Miscellaneous Lamps.

Energy Considerations

The amount of energy used for lighting is an important consideration in food premises.

Energy use accounts for at least 15% of total operational costs in a food and beverage manufacturing business[xii]. Lighting accounts for up to 40% of energy use[xiii] in commercial premises.

Older style lighting, which includes incandescent, halogen and metal halide lights, is much more energy intensive than modern LED systems, which can use up to 75% less energy than traditional lighting[xiv].

Traditional lamps also create heat, which can put an extra energy load on cooling systems like air conditioning systems. It's therefore important for food businesses to choose the most energy-efficient lighting, so long as it meets the business' other needs.

> LIGHT EMITTING DIODES (LEDS) USE UP TO 75% LESS ENERGY AND EMIT 90% LESS CO2 THAN THE OLD HALOGENS. THEY ALSO LAST UP TO 25 TIMES AS LONG, WHICH GREATLY REDUCES THE NEED FOR CHANGING OR MAINTENANCE. THIS IS ESPECIALLY USEFUL WHERE FITTINGS ARE DIFFICULT TO ACCESS.
>
> *Department of Industry, Science, Energy and Resources (Australia)*
> *Lighting Guide for Businesses*

Many companies are switching to LED lighting solutions for energy savings. While there are significant energy savings to be had, it should be noted that many LED luminaires need to be completely replaced when the LEDs fail, because their LED boards are permanently integrated into the luminaire. LED lifetime is therefore an important consideration because energy savings could be outweighed by the cost of completely replacing entire luminaires at the end of their life.

Before choosing a light, always check the manufacturer's specifications for its *useful life*.

Motion sensors and daylight sensors that can switch off lights when they are not needed can contribute to energy savings.

Hot and cold areas are common in food premises and the temperatures in such areas can impact the energy demand of lights, as well as their lifespans. Hotter areas can cause LEDs to degrade faster[xv]. Colder areas do not cause LEDs to degrade faster.

Pests and Lights

Luminaries as a Harbourage or Ingress Point for Pests

Luminaires can be an attractive harbourage for live pests and a repository for dead pests.

In food premises, free-hanging luminaires should be sealed to prevent ingress of insects. Ceiling-mounted or wall-mounted luminaires must be sealed to the surrounding ceiling or wall to prevent insects from using any opening behind the light to gain access sensitive production. It also prevents crawling insects like cockroaches from breeding or sheltering behind the luminaire.

Luminaires that are high off the ground can be attractive places for spiders, flying insects and even birds to nest, if the lights are used infrequently. Suspended luminaires with cup-shaped indentations on their top surfaces are attractive to pests and are also very difficult to clean and should therefore be avoided.

Light: A Potential Source of Attraction For Pests

Exterior lighting for food premises needs to be carefully chosen so that lights do not inadvertently attract insects towards buildings at night.

Different coloured lights have different insect attracting properties[xvi], with colours that more closely mimic natural white daylight generally being more attractive to insects than warmer hues[xvii]. Lights that emit a lot of heat can also be attractive to insects.

The types of pests in an area and the species that are most relevant to the products inside the facility will influence which colour tone should be selected to minimise insect activity. A pest specialist should be consulted for advice.

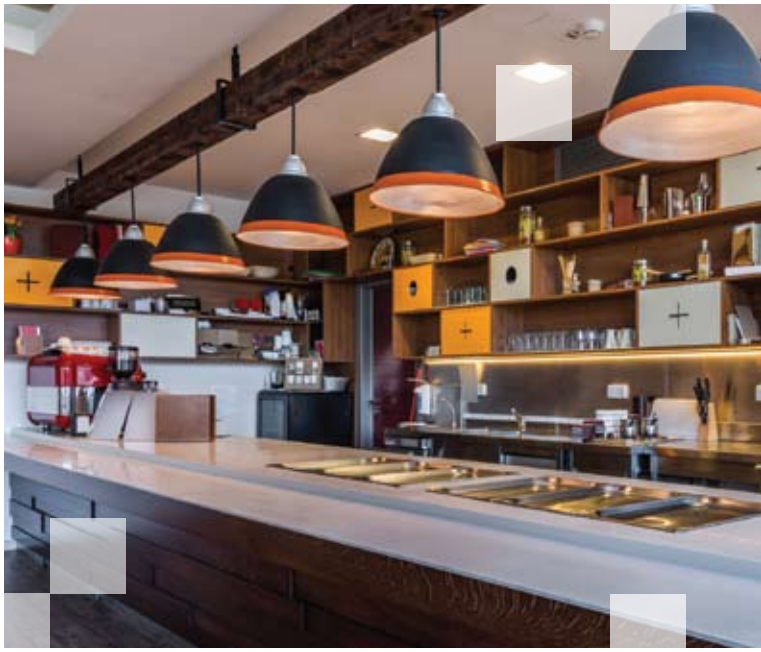
Changing Light Bulbs in a Food Facility – Best Practices

- It can be more efficient to use planned preventive maintenance times to conduct in-bulk lamp (“bulb”) changes, rather than changing single lamps on anad hoc basis.
- Lamp changes should be done during operation down-time wherever possible. This will reduce the risk of contamination events.
- When performing lamp changes, transport the new lamps in their original protective packaging. Have sturdy containers like buckets or plastic totes on hand to collect the old lamps.
- While changing lamps, take the opportunity to also clean the luminaires, particularly in the case of high bays which are difficult to access under ordinary circumstances.
- Fluorescent tube lights should have their electronic starters replaced on a regular basis as well as their tubes (lamps).
- As with all preventive maintenance activities, keep a record of what was done, where and when.

Other Considerations for Lighting in Food Premises

Front-of-house areas like foyers, dining rooms and reception areas need lights that are aesthetically pleasing to visitors and diners. The shape, colour and material of luminaires all have a role to play, as does the lumen output and colour temperature of the lamp.

Luminaires should be easy to keep free from dust, cobwebs and insect-bodies. As with lights in food preparation areas, consideration should be given to how broken lamp fragments will be retained in the event of breakage, especially for lights installed in public dining areas.



In areas with constantly opening doors, such as in quick service restaurants, there is a risk of flying insects coming through the doors. In these situations, the shape, placement, intensity and colour of interior lights can affect insect behaviour, and some lights may attract insects inside the facility. Consult a pest specialist for advice about where to situate lights, and which styles of fixture and lamp can minimise the risk of inadvertently attracting insects inside the facility.

Lighting for cool rooms, freezers and cold stores have special requirements because not all lamps operate effectively at cold temperatures. The manufacturer's specifications and temperature ratings need to be checked carefully before choosing lights or lamps for use in cold areas.

What is food-safe lighting?

1) Food-safe lighting allows workers to perform tasks, including food preparation and cleaning, effectively and safely.
2) Food-safe lights are
    a. Shaped so that they are easy to clean.
    b. Designed to reduce the risk of plastic, metal or glass getting into food or food handling areas.
    c. Able to be installed or mounted in a hygienic and pest-proof manner,
    d. Made from corrosion resistant, shatter-resistant, non-porous, smooth materials.
    e. Able to be maintained and cleaned without causing contamination of food handling areas or damage to the luminaires.

What To Do If A Light Breaks?

When a lamp ('bulb') or a luminaire breaks, it's critical to have an effective response in place to prevent food contamination.

Your company should have written procedures that explain how you will deal with breakages and perform clean-up operations, and these should include details about how you will clean up any hazardous materials like glass, hard plastic, chemicals or batteries which may spill out during these events.

The breakage procedure should include an immediate quarantining step, in which all areas affected are isolated and inspected. Production must be stopped. Product in the area must also be isolated and quarantined.

It is important to try to collect and account for all pieces of the broken lamp, fixture or cover.

Next, any food product that could have been contaminated must be collected and discarded. Then a full clean of the area must be done.

The breakage procedure should describe how to collect and clear away the broken item as well as how to clean the areas that could have been contaminated. Equipment and cleaning products should be described, as well as the steps in the process. Cleaning steps can include a 'macro' clean such as brushing, a detailed or 'deep' clean, rinsing, drying, inspection and a sign-off by a supervisor.

When a lamp breaks, it's important to consider the type of chemicals that may be released and describe how you will manage any potential chemical contamination. Safety Data Sheets provide information about high-risk lamp types, such as mercury lamps. The procedure should describe how such lamps will be disposed of.

After the area is cleaned, workers' boots should be inspected, thoroughly cleaned or changed.

The procedure should describe which people or roles(s) are responsible for quarantining the area; deciding how much product to discard; confirming correct disposal of product and hazardous material; performing inspections post-cleaning; and authorising recommencement of production.

It is important to keep records of all breakages and the actions taken to clean up each incident, so that any future consumer complaints related to the incident can easily be investigated.

Food Safety Standards and Requirements for Lighting

The United Nation's Food and Agriculture Organisation (FAO) operates an international entity responsible for global food standards and food safety, known as the Codex Alimentarius Commission. The commission publishes the Codex Alimentarius which means 'book of food' and is a collection of standards, guidelines and codes of practice for the international food community. Section 3.2.6 of the *General Principles of Food Hygiene* of the Codex Alimentarius specifies lighting requirements for food premises, including the need to provide adequate light intensity and the need to use hygienically designed fixtures that provide protection against contamination if damaged.

The Codex Alimentarius also describes the principles of HACCP, which stands for Hazard Analysis Critical Control Point. HACCP is a set of protocols that form the foundation of all food safety plans, which are used to ensure that food is manufactured in a consistently safe manner.

There are a number of HACCP-based food safety standards used by the food industry, which each describe requirements for lighting in food facilities. These requirements typically specify that sufficient light be provided so that workers can perform tasks correctly. They also require that lights in areas with exposed food be shatterproof, easily cleanable and included in cleaning and sanitation schedules.

The most popular standards are endorsed by The Global Food Safety Initiative (GFSI), an initiative created and managed by The Consumer Goods Forum which recognises best practice in international standards.

Most GFSI-recognised standards owners provide guidance and recommendations for food businesses that describe how to select and operate luminaires and lamps in food premises.

How to Choose a Food-Safe Light

Food-safe lights are critical in areas where there is open or exposed food, such as in kitchens, processing areas, packing areas and retail display areas. It is good practice to also have food-safe lights in food storage areas, including cold storage, warehouses and dry stores.

HACCP International certifies lighting solutions that are food-safe and suitable for use in food premises. You can see a list of certified lights on our website https://www.haccp-international.com/registers/. For more about the certification scheme, see *HACCP International's Certification for Food-Safe Lights* on page 17.

Selecting the appropriate type and location for light sources is important because adequate lighting is needed to provide comfort for workers when performing tasks, ensure safe operation of equipment and assist with cleaning. Lights in food premises should be operative and clean; designed in accordance with hygienic principles so that they are easy to keep clean, free from loose items that could become physical contaminants and must be designed or enclosed to prevent contamination of food and food areas in case of breakage.

Emergency Lighting

Emergency lighting is strictly regulated and regulations vary from place to place. Therefore, any emergency lighting for critical food-handling areas must first be confirmed to be in compliance with local standards, rules and recommendations before other criteria are considered.

Factors to consider when selecting luminaires for food handling areas

The amount of light in each different area of the food facility must satisfy the legal requirements of the local government area or country. Once the required level of illuminance has been identified for a particular part of the facility, a lighting expert should be engaged to determine the location and output of the lights. Environmental factors such as ceiling height, shadowing, corners, wall colour and the presence of reflective surfaces near the luminaire, as well as levels of natural light all need to be considered.

Food-safe lighting is bright enough for workers to perform tasks effectively and does not create contamination risks. This means that the lights must be hygienically designed and installed so that they are easy to clean, impervious and corrosion resistant.

Luminaires that have smooth surfaces, large radius internal corners and that are made from materials resistant to corrosion are less able to harbour dangerous pathogens, making them better choices for the food industry. Likewise, for suspension-mounted lights, food-safe designs have sloping top surfaces, and rounded, widely-spaced heat-dispersing fins which collect less dust and debris and are easier to keep clean.

Luminaires in food facilities should be designed so that there are no parts or pieces that could come loose during normal use, and so that they do not contaminate surrounding areas during maintenance activities or in the event of breakage.

For wet environments, and in areas that need to be cleaned with water, luminaires should have the correct level of ingress protection (IP), to protect the lights from water damage, and to prevent water accumulating in or on the fixture.

Energy-efficiency must also be considered, as well as the lifespan of the lamps and fixtures, plus the cost of replacement.

HACCP International's Certification for Food-Safe Lights

HACCP International certifies certain luminaires and lamps as food-safe and suitable for use in food premises where the food handling operations are governed by a HACCP-based food safety programme.

In order to confirm their suitability for certification, HACCP Internationals' technical team evaluate lighting products by performing a risk-based hazard analysis based on the principles of HACCP as described in the Codex Alimentarius of the World Health Organisation. The HACCP International Food Safety Standard *FOOD SAFE PRODUCTS and SERVICES for FOOD BUSINESSES* describes this evaluation process and defines requirements for certification.

During an evaluation for certification, a luminaire or lamp is assessed. The assessment includes a consideration of the materials of composition, principles of hygienic design, including cleanability and pest ingress protection, presence/absence of potential physical contaminants during normal use and in the event of breakage, installation methods and accompanying instructions and recommendations.

Common reasons for luminaires to fail the evaluation process – and therefor be ineligible for certification are:

- Small loose or improperly retained fasteners or clips that could become physical contaminants.
- Surfaces with joints, nooks, crannies or low-radius internal corners that are difficult to clean.
- Spaces, gaps or openings that would allow insect ingress that can't easily be cleaned away.
- Top horizontal surfaces or indentations that could collect dust and that couldn't be easily wiped or brushed clean.
- Narrow spacing on heat-radiating fins that would be difficult to clean with a brush or by wiping.

Conclusion

Food premises are buildings within which a broad range of activities are conducted, including food manufacturing, food retailing, food storage and food service activities.

Each unique food facility has many different areas, and each area has its own lighting needs. From exterior areas to cold storage rooms, loading docks, kitchens, food display halls and dining areas, each of these areas have different requirements for lighting and lighting equipment.

Lighting solutions for food premises must be chosen for their illuminance, ability to be cleaned, colour temperature, energy consumption, ingress protection, breakage resistance and – for dining areas – design and aesthetic requirements as well.

Food-safe lighting is essential in any food-related business. Not only does it keep food products and customers safe by being free from sources of contamination, it also helps maintain hygiene standards by supporting workers' ability to perform efficient, effective sanitation operations.

To learn more about HACCP International's certification for food-safe equipment, materials and services, email us at info@haccp-international.com.

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