Effectively lighting wastewater and water treatment facilities

Understanding the unique lighting challenges of a hazardous environment can help you specify the safest — and most efficient — lighting system.

In wastewater and water treatment facilities, updating to a successful, quality lighting system is a sure way to reduce energy usage, maintenance costs, and meet stringent safety requirements. Lighting is often an afterthought during the planning and construction phases, but well-informed facility managers can avoid common mistakes and benefit from improvements in lighting technology.

Upgrading a lighting system is an attractive cost-saving initiative because it pays back quickly and can be installed quickly without hampering operations. However, not selecting the appropriate solution can actually decrease productivity and increase maintenance costs and accident rates.

With hundreds of choices available, one needs to have a basic understanding of a lighting system and the environment in which it will be installed. The goal of any lighting project should be to provide an adequate amount of light where and when it is needed, and to complete work tasks safely and most effectively.

Lighting requirements unique to the demands of the wastewater and water treatment industry can make selecting the most appropriate solution a challenge. The National Council on Qualifications for the Lighting Professions (NCQLP) offers assistance in finding Lighting Certified Professionals who can help with this process. An expert can help you establish goals and perform a detailed audit and analysis of the existing or proposed space.

Select a vendor partner that will help you succeed long-term. Conduct due diligence around past installations with similar requirements (ask for references) and confirm their financial stability to help ensure a successful project.

Once you establish your goals, there are some basic steps to selecting the most appropriate lighting solution for your facility.

Know your environment

The geometry, construction of space, and presence of hazardous chemicals will influence your lighting selection. Areas that are classified per the National Electric Code as hazardous locations must have luminaires designed and suitable for performing in such environments. Areas in wastewater and water treatment plants where combustible liquids and gases, such as chlorine and sulfur dioxide, exist in sufficient quantities require luminaires that are specifically approved for use in hazardous environments by a third-party listing agency such as Underwriters Laboratories (UL) or Canadian Standards Association (CSA).

In certain applications or geographical areas (think coastal), luminaires must be resilient enough to withstand corrosion, humidity, and/or higher ambient temperatures to deliver long-term performance and durability. Industrial luminaries listed by third-party agencies have an ambient rating — typically 25° C, 40° C, 55° C or 65° C (although Celsius is standard for the lighting industry, that translates to 77° F, 104° F, 131° F, or 149° F).

Take care to understand your maximum ambient temperature at the mounting location during your hottest season. Exceeding the luminaire ratings may severely impact the performance and life of your lighting system.

share this article at http://go.hw.net/wwtp

For corrosive and high-humidity environments, your first line of defense is material selection. Nonmetallic, aluminum, or stainless-steel enclosures are generally accepted materials for corrosive environments, along with electro-static coatings such as polyester or epoxy. For additional protection, try luminaires listed for Outside Type (salt water) that are subjected to a salt spray test for at least 200 hours, as indicated in the ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus.

In applications where significant vibration is likely, select a luminaire designed to operate in those conditions — including its mounting apparatus and internal components. If vibration is a concern, request vibration data from your vendor to ensure the unit will perform adequately in the application. (There is no industry standard for lighting equipment vibration in wastewater and water treatment plants.)

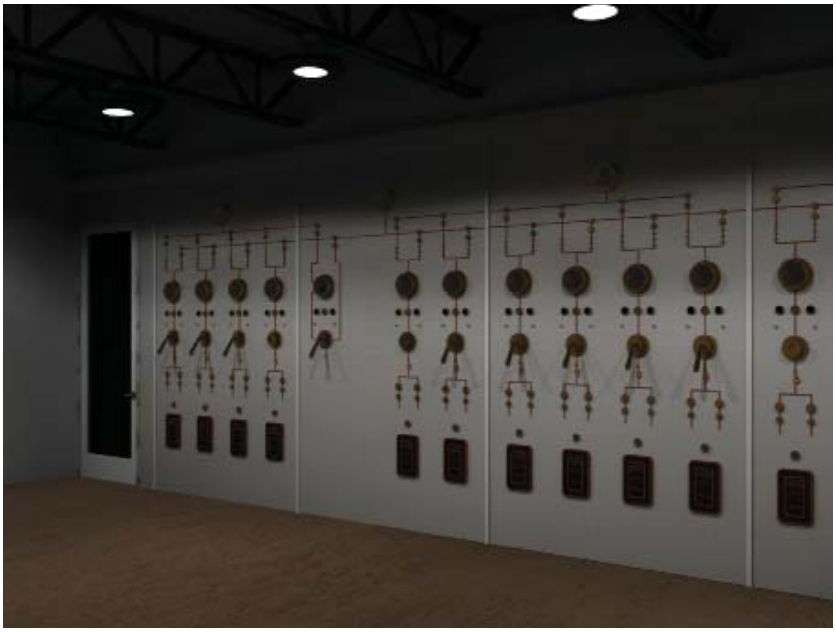
Illumination considerations

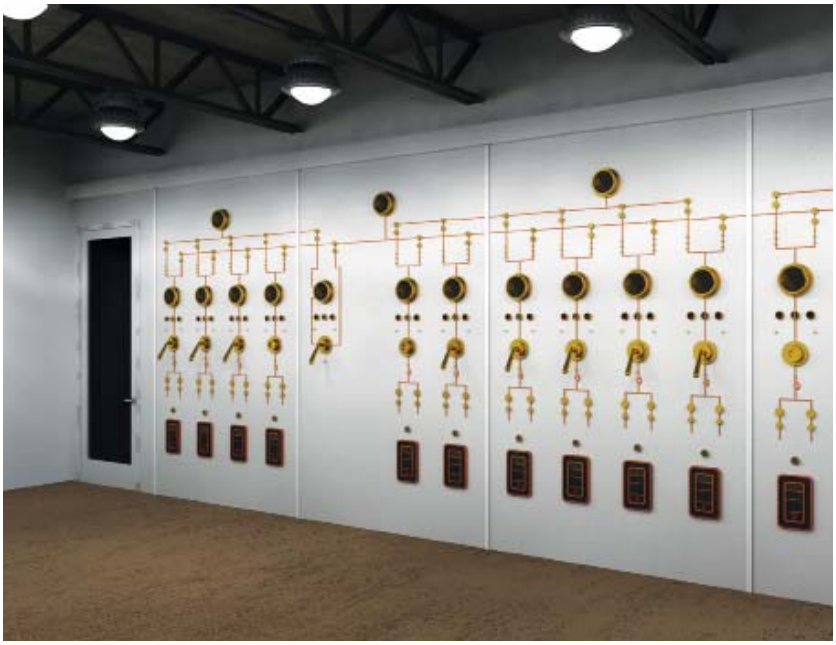
A lighting system that provides optimized visibility and visual comfort helps promote a safe work environment and can increase productivity. When upgrading a system, don't just settle for existing light levels, which may be inadequate if the source has depreciated from its initial output.

If employees must use flashlights to accurately monitor gauges and check valves in the pumping station, it's safe to assume that current light levels are severely insufficient. Consult the latest recommendations of the Illuminating Engineering Society of North America (IES). The Recommended Practice for Industrial Lighting (RP-7) is also a great reference.

Consider the amount of light reaching both vertical and horizontal surfaces of the application (measured as "footcandles") when selecting a lighting design. Well-lit, vertical surfaces are important for occupants to monitor gauges and work on equipment. Higher levels of light should be considered for tasks like equipment inspection and repair.

Getting the right quantity of light out of a luminaire does the facility no good if it doesn't evenly illuminate the workspace, or if it causes excessive glare that may compromise general visibility. A nonuniform space (think hot spots and dark spots) may be distracting depending on the task, and glare may cause discomfort and lower productivity. Selecting the most appropriate optical design and wattage can provide the correct balance between quantity and quality of light in the workspace.



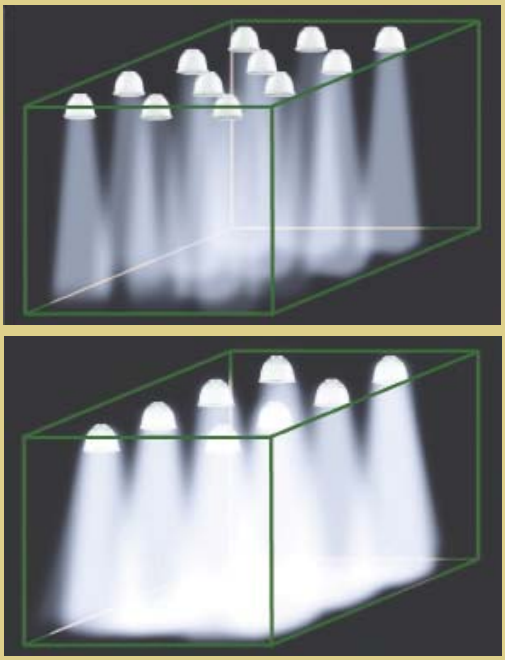


Adequate lighting for vertical surfaces, such as control panels, is important for keeping daily operations running smoothly – and critical in emergencies. Follow your lighting system's maintenance requirements, which will depend on light source and location. Photos: Holophane

Another consideration is color rendering, or the ability of the light source to represent an object's true color. If a plant employee is working in an area where pipes are color-labeled, it is important that those colors are rendered properly and visible in the space. This can be achieved with a high-CRI (color rendering index) light source.

All light sources — light-emitting diode (LED), fluorescent, metal halide, compact fluorescent, and incandescent — depreciate over time. Loss factors take into account all aspects of the environment, the luminaires' construction,

(continued)



Not all lighting fixtures are created equal. Inferior optic design can actually require more fixtures and provide less uniform illumination (top). Optimized optical control can dramatically improve distribution and uniformity, with fewer lighting fixtures (bottom).
Photos: Holophane

and performance of the lamp source. To ensure the facility is providing adequate lighting over a specified period, these factors must be considered during the design phase.

Loss factors include luminaire dirt depreciation, lamp lumen depreciation, thermal factor, and ballast factor. Most luminaires in wastewater and water treatment plants will be enclosed and gasketed due to humidity and corrosion concerns. Dirt and dust are more likely to accumulate on this type of fixture than on an open fixture. As a result, less lumens or light will actually hit the work plane over time.

Lamp lumen depreciation is inherent to the design of any light source, and each depreciates at a different rate. For example, a standard linear fluorescent 32 W T8 lamp (bare) has initial lumens of approximately 2,900 and depreciates only 5% at 40% of its rated life (36,000 hours). However, the T8 lamp is also sensitive to ambient temperature fluctuations and won't achieve 100% lumen output if it is run hotter or cooler than its intended operating temperature.

LED technology is gaining a lot of traction in this industry; it's perceived to provide significantly longer life over the next best light-source technology. This is true with the right luminaire and under the right environmental conditions — the manner in which the internal LED temperature is managed has a direct and significant impact on both life and light output.

Luminaires that are unique to the wastewater and water treatment industry range from 50,000 to 70,000 hours of life before they depreciate by 30% (known as the L70 life). This doesn't mean, however, that they are maintenance-free. Other electrical components, such as the electrical driver, must also be rated for the same life for a truly maintenance-free luminaire.

Ask your lighting partner about the L70 life of specific luminaires at 25° C, 40° C and 55° C (or 77° F, 104° F, 131° F). What is the driver life at those specific ambient temperatures? Unlike traditional lamps, LEDs emit light in a highly directional beam, so the optical design of the luminaire is increasingly important to be visually comfortable for people moving about the space. Consider investing in a properly designed LED luminaire that can reduce your maintenance and energy costs.

With many lighting technologies on the market today, it's important to evaluate them per the application space, as each has its unique pros and cons. (See below)

Controls must also be considered in a lighting upgrade project. Today, many

LIGHTING SOURCE COMPARISON CHART

Source	Efficacy	L70/lamp life (hrs)	Ballast/ driver life (hrs)	Color rendering Index (CRI)	Color temperature* (Kelvin)	Instantly on	Biggest advantage	Biggest challenge	Cost
LED	70-140	50,000-70,000	50,000	65-85	4,000-6,000	Yes	Technology speed, great LLD, long Life	Cost, heat management	$$$
Induction	60-75	100,000	50,000	80	3,000-4,000	Yes	Long life	Size (optical control), heat management	$$
Metal halide	70-120	12,000-20,000	100,000	65-90	2,800-4,200	No	CRI, heat management	Life (lumen) maintenance	$
High-pressure sodium	100-130	24000-30,000	100,000	22	2,100	No	Efficacy, great LLD	CRI	$
Fluorescent	80-100	24,000-40,000	60,000	80-90	3,000-5,000	Yes	Great LLD, long life	Lamp size, heat management	$

Source: Holophane

* Color temperature is a method by which to distinguish the spectral properties of a specific light source. Measured in Kelvin, a lower color temperature has a warmer light while a higher color temperature has a more blue light.

facilities run their luminaires 24/7 or use contactors to operate their lighting systems. With rapidly adopted legislation such as the EPA's Energy Policy Act, the California Energy Commission's Title 24, the International Energy Conservation Code (IECC), and policies of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), facilities can't ignore automated control.

Controls can be scaled to fit your budget. You can recude energy with simple ambient-light-detection devices such as photocells, or a more complex solution such as occupancy sensors that are integrated into the luminaire to relay panels and dimming systems. A Lighting Certified Professional can help design and specify a controls feature.

How to get funding

We've all done it, but the process can be daunting. The best advice is to get top management's buy-in from the beginning. Understand your financial hurdles before getting started. Are safety or regulatory requirements also factors? Could utility rebates and tax credits accelerate your financial payback? By defining requirements up front and selecting the most appropriate and energy-saving solution, you can meet your organization's goals.

Federal and state governments are aggressively looking for ways to reduce energy consumption. Many agencies offer financial incentives for efficient lighting systems. Tax incentives such as the Energy Policy Act of 2005 allow deductions for lighting upgrades up to $.60/square foot, subject to a cap, for projects completed through 2013. Many utilities offer product- or performance-specific incentives. Some states sponsor grant programs for efficiency upgrades. Ask your local utility and your lighting partner for updates.

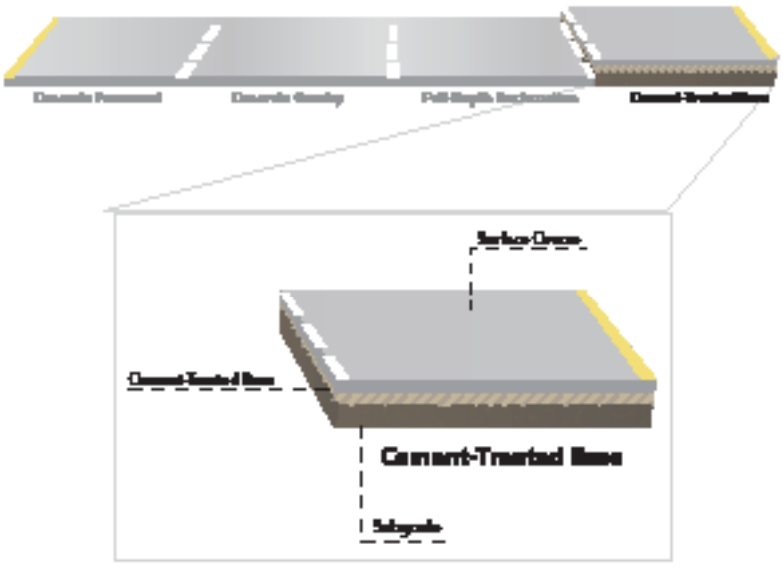
Many decision-makers focus on initial costs of a lighting system without considering long-term implications. But it's important to know the life cycle — or total system — costs up front. Total life-cycle costs include initial installation (material and labor), operational (energy), and maintenance costs. With the typical life of an industrial lighting system around 15 to 20 years, operational and maintenance costs will far outweigh the initial cash outlay. Addressing these costs will give you the biggest bang for your buck, and allow you to focus precious resources on your workforce and operational productivity.

A quality lighting system that meets your organization's financial hurdles must be properly weighed and balanced before a final design is accepted. However, when you complete an effective and reliable lighting upgrade, your facility will reap the benefits of energy conservation and productivity for years to come. PW

— Williamson (tamar.williamson@acuitybrands.com) is the indoor products manager for Holophane, an Acuity Brands company.

CEMENT-TREATED BASE.

BECAUSE ROADS NEED SOMETHING TO RELY ON.



Without a solid base, roads don't stay roads for long. A weak base leads to the rutting, alligator cracking, and potholes commonly associated with asphalt. Cement-treated base gives your road surface a solid backbone that spreads loads across a wider area, minimizing the impact of traffic and making your investment last years longer. To learn more, visit www.thinkharder.org/paving.

PCA

think harder. concrete.

Circle 234 on reader service card