As our populations have grown, many people have an increasing amount of leisure time. They are looking for healthy recreational opportunities for themselves, for their children, and for senior citizens. One way of meeting this demand is to provide illumination for existing parks and play areas. When new facilities are built, they usually include a night lighting system. These facilities bring pleasure to many, but they also bring irritation and annoyance to those who live nearby. The lighting systems are visible for miles around and produce a substantial amount of sky glow and light pollution. Lighted sports facilities are the most commonly mentioned system when people discuss light pollution in the nighttime environment.

Many cities have large outdoor professional sports venues. It is essentially impossible to mitigate the impact these types of facilities have on the surrounding areas. The amount and type of illumination are driven by television broadcasting requirements, and glare control of the luminaires is essentially impossible or not effective. However, these large, professional facilities do not normally operate every night of the week and are usually located some distance from the residential areas of the city.

This is not the case with the many recreational areas that have night lighting systems. The facilities are normally in or near residential areas and are operated several nights a week and year around or as long as weather permits. The off-site impact of these facilities can be reduced to some extent by utilizing several options. One of the most important is proper mounting heights of the luminaires. Many people think that low mounting heights help reduce the off-site impacts of the illumination system. This is exactly the opposite of the actual effect. The lower the mounting height, the higher the aiming angle and the more light that is delivered off site. This emphasizes the importance of having the facility designed by an experienced sports lighting professional. These systems need to be installed by a licensed electrical contractor in most jurisdictions, so design should be done by a licensed engineer. A selection process should be used to ensure that the best qualified and most experienced person is picked for this.

The Illuminating Engineering Society of North America (IESNA) has a Sports and Recreational Areas Lighting Committee. This committee develops standards and design criteria for various sports, both indoor and outdoor. This information is published as “Recommended Practice for Sports and Recreational Area Lighting,” (IESNA RP-6-01). The criteria are divided into several major sections plus five annexes, an extensive glossary of lighting terms, and a reference/bibliography pertaining to sports lighting design. While the RP covers recommendations for both indoor and outdoor sports, this summary will only cover outdoor sports.

RP-6 has established four classes of facilities, based mainly on the number of spectators, and provided illumination recommendations for each. They are as follows:

- Class I: Competition play before larger groups, from 5,000 to 10,000 or more spectators. The design criteria may not fully cover this type of facility, whose vertical and horizontal needs may be defined by individual sports and/or broadcasting organizations.
- Class II: Competition play with facilities for up to 5,000 spectators.
- Class III: Competition play with some spectator facilities.
- Class IV: Competition or recreational play only, with no provision for spectators.
In general, the recommendations for Class IV are normally sufficient for most recreational sports facilities. When spectator facilities are added and the distance from the spectators to the field becomes greater, the illumination levels need to be increased. These higher levels are for the spectators; the lower levels are considered sufficient for the players.

*Multidirectional aerial* sports are those in which players and spectators view the playing object from many positions and angles. These sports require vertical illuminance over the height of the entire playing area and horizontal illuminance at ground level. Direct glare at the most frequent viewing directions must be avoided. These sports include badminton, baseball, basketball, football, handball, jai alai, ski jumping, soccer, squash, tennis, and volleyball.

*Unidirectional aerial* sports, in which the playing object is viewed in the air from a fixed position on the ground, require horizontal illuminance where the playing object starts and vertical illuminance where the playing object lands or is intercepted. Such sports are golf at a driving range and skeet and trap shooting.

In *multidirectional ground level* sports the players and spectators view the playing object from multiple positions, normally downward, horizontally, and occasionally upward. These sports include boxing, curling, field and ice hockey, skating, swimming and wrestling.

The playing object in *unidirectional ground level* sports is aimed at a fixed target, usually in a vertical position, near ground level. These sports include archery, bowling, skiing, and target shooting.

**Fundamentals of Good Illumination**

The goal of good sports lighting is to provide a luminous environment that contributes to the contrast of the playing object (ball), the competitors, and the surrounding backgrounds. Contrast is a function of the luminance of both the target and the background. Good design takes into consideration direct and reflected glare, color rendering, and color contrast.

The lighting recommendations also seek to minimize spill light, or light trespass, in areas near the sports facility. The lighting fixtures commonly used for sports lighting may be huge sources of direct glare, affecting not only nearby areas and those at considerable distances from the sports field, but also spectators and players using the facility. The brightest single source of light visible in a city nighttime landscape is often a sports facility. It is, then, no surprise that such lighting is usually the single greatest source of complaints and neighborhood tension. Designing excess light increases construction, operating, and maintenance costs and wastes energy.

**Equipment and Design Factors**

RP-6 covers light sources and equipment commonly used in sports lighting, along with their characteristics and typical applications.

The two light sources commonly used for sports facilities are high-intensity discharge (HID) and fluorescent. HID lamps, which are long lived and have high efficacy, may be metal halide or high-pressure sodium (HPS). However, when these lamps are turned on or restarted, they have a time delay, followed by a slow buildup of light output.

While fluorescent lamps provide relatively high efficacy, long lamp life, low brightness, and good color rendering, their physical length gives poorer optical control and they are very temperature-sensitive.

Luminaires offer a wide choice of optical characteristics. Based on their optical performance and mounting at the correct height and position, luminaires provide a lighting system with the desired characteristics. Luminaire designations explain how light from the lamp is controlled by the optical system and describe the fabrication of the complete unit. Since indoor and outdoor applications involve unique problems, lighting equipment is distinctly classified and designated accordingly.
Indoor sports applications have similar design and calculations as those of any interior system. The walls and ceilings provide a means to control background luminances and assist in diffusing the available light.

Outdoor lighting choices are more limited, usually made up of direct distribution floodlights aimed at the playing surface. Full cutoff optical systems are now available for most recreational level sports applications. In fact, the full cutoff optical systems actually provide superior visibility for the players as well as the expected reduction in off-site impacts. HID sources (metal halide or high-pressure sodium) are the choice for most outdoor sports locations.

In the past, fixtures, lighting designs, and the general level of the sports lighting state of the art often left little choice for communities and designers seeking to minimize spill and glare in sports lighting. Many facilities, especially older ones, continue to produce enormous amounts of light spill into adjacent areas, as well as direct and reflected light into the sky.

Recently, several luminaire manufacturers have begun to produce well-shielded - even fully shielded - luminaires suitable for sports lighting, particularly for the most commonly needed levels of lighting. These designs provide major reductions in off-site spill and can reduce or even eliminate direct uplight. This equipment must be carefully applied to provide the visibility to the players necessary for softball, football, and similar sports where the ball must be seen well above the playing surface. Proper mounting heights and mounting locations help these designs deliver improved lighting quality for the players on the field.

With quality designs using up-to-date fixtures, the obtrusive effects of lighting can be considerably reduced, but the huge amounts of light required in certain situations will always produce some negative impacts, even with the best design.

Illumination Recommendations for Outdoor Sports

Recommendations for illuminance values, uniformity ratios, and design considerations in facilities for specific outdoor sports are given for many sports.

The five annexes cover illuminance calculations, field measurement and performance evaluations, floodlight aiming, light loss and maintenance, and lighting economics.

Communities need to be aware of the potential impacts of a sports facility, and its location and alignment should be carefully considered. Technical specifications for sports lighting can be included in a lighting code that requires fully shielded lighting where possible and professional design and post-installation certification to ensure that standards are followed.

The RP is available from IESNA (www.iesna.org) and is a must for anyone interested in sports and recreational lighting.