



McDonald Observatory
The University of Texas at Austin



Recommended Lighting Practices

A Collaborative Effort by the Permian Basin Petroleum Association,
the Texas Oil and Gas Association, the American Petroleum Institute
and the McDonald Observatory*

*Much of the language herein was adopted from a Bureau of Land Management Document, "Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands" (BLM/WY/PL-13/013+1340).

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Introduction: These recommended lighting practices are a result of collaboration between the members of the Permian Basin Petroleum Association (PBPA), headquartered in Midland, Texas, the Texas Oil and Gas Association (TXOGA), headquartered in Austin, the American Petroleum Institute (API), headquartered in Washington, DC, and The University of Texas McDonald Observatory, located near Ft. Davis. The PBPA, TXOGA, and API strongly support the McDonald Observatory and the endeavors it strives to accomplish. Knowing that dark skies are vital to those endeavors, the PBPA, TXOGA, API, and the Observatory offer the included recommendations to accomplish just that. These recommendations are targeted at operations in the Texas counties of Brewster, Culberson, Hudspeth, Jeff Davis, Pecos, Presidio, and Reeves to help protect the Observatory, but are equally beneficial across the industry.

From all of us at the PBPA, TXOGA, API, and the McDonald Observatory, and in particular from the members of the Dark Skies Initiative, thank you for following these recommendations, and for helping to keep the skies of West Texas dark.

Regards,



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PBPA, President



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Todd Staples
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1. Prepare a Lighting Plan

Project Phase: Siting and Design

It is recommended that a lighting plan be prepared documenting how lighting will be designed and installed to minimize night-sky impacts and impacts on nocturnal wildlife during construction and operations. The lighting plan should specify the following:

- (1) Number of lights and lumen output of each—Minimum number of lights and the lowest luminosity consistent with safe and secure operation of the facility;
- (2) Alternatives to lighting—Retro-reflective or luminescent markers in lieu of permanent lighting where feasible;
- (3) Fixture design—Lights of the proper design, shielded to eliminate uplight, placed and directed to eliminate light spill and trespass to offsite locations;
- (4) Lamp color temperature—Lights of the proper color to minimize night-sky impacts;
- (5) Standard operating procedures—Minimization of unnecessary lighting use through alternatives to permanent lighting, such as restricting lighting usage to certain time periods;
- (6) Any activities that may be restricted to avoid night-sky impacts; and,
- (7) A process for promptly addressing and mitigating complaints about potential lighting impacts

Limitations: Safety and security must be considered in developing a lighting plan for facilities and access roads. The FAA, OSHA, and other agencies may have regulations governing lighting practices that must be considered in designing facility lighting.

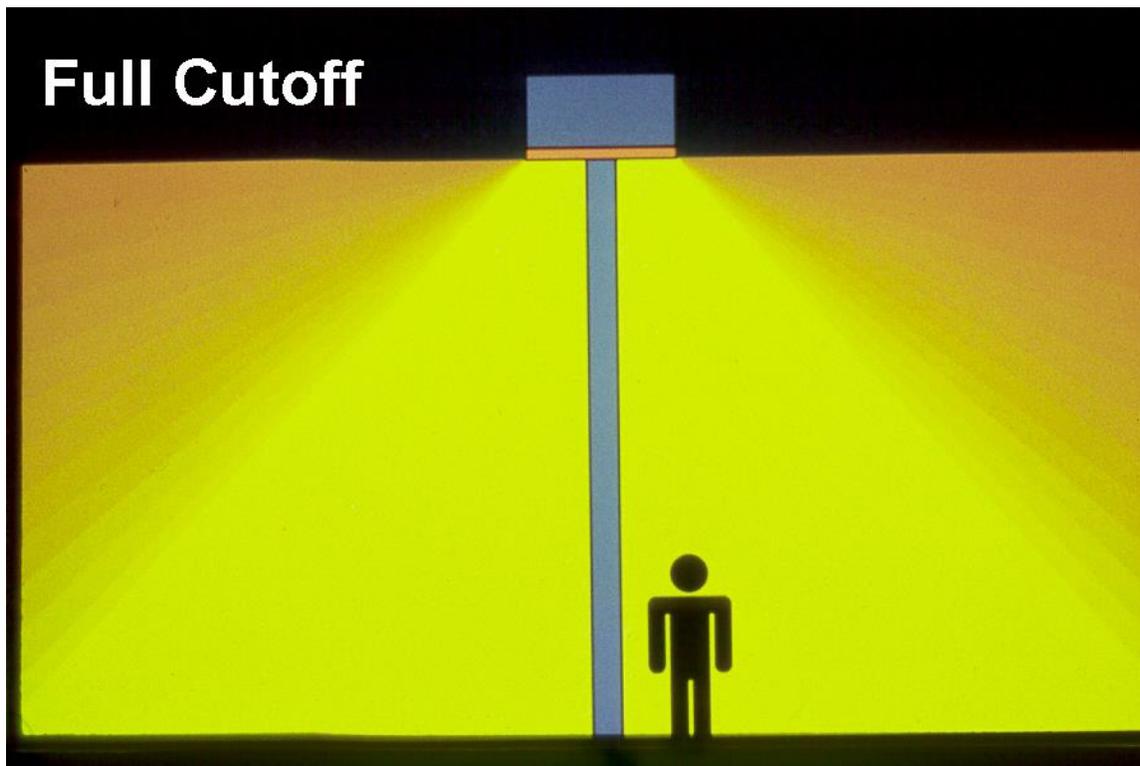
2. Use Audiovisual Warning System (AVWS) Technology for Hazard Lighting on Structures Taller than 200 feet

Project Phase: Siting and Design

If the FAA approves AVWS technology for general use, it should be used for structures exceeding 200 feet in height. If the FAA denies a permit for use of this technology, the project developer should limit the amount of lighting to the minimum required by the FAA, in order to minimize visibility beyond that required to meet safety requirements.

3. Use Full Cutoff Luminaires

Project Phase: Siting and Design

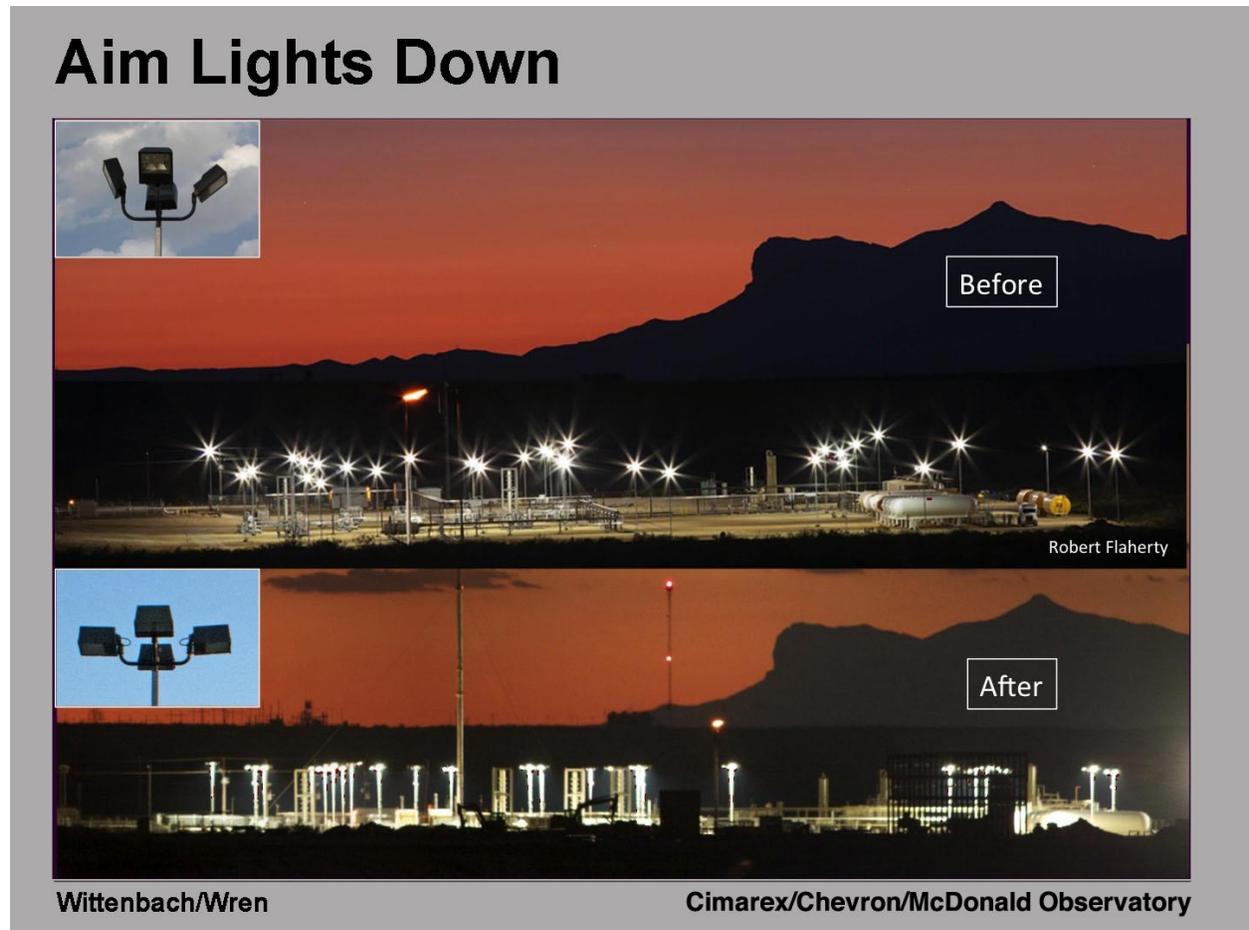


Except as required to meet the minimum safety and security requirements (e.g., collision markers required by the FAA, or other emergency lighting triggered by alarms), it is recommended that all permanent lighting use full cutoff luminaires, which are fully shielded (i.e., not emitting direct or indirect light above an imaginary horizontal plane passing through the light source). It is also recommended that all permanent lighting meet the Illuminating Engineering Society (IES) glare requirement limiting intensity of light from

the luminaire in the region between 80° and 90° from the ground. It is further recommended that all fixtures be mounted properly, at the proper angle.

4. Direct Lights Properly to Eliminate Light Spill and Trespass

Project Phase: Siting and Design, Construction



Construction and permanent lighting should be mounted and directed to focus light only on the intended area, and to avoid light spill and offsite light trespass. Lights pointing upward or horizontally should be avoided.

Limitations: Safety or functional considerations may dictate lighting practices that result in some light spill or light trespass.

5. Use Amber instead of Bluish-White Lighting

Project Phase: Siting and Design



When accurate color rendition is not required (e.g., roadway, basic security), it is recommended that lighting be amber in color, using either low-pressure sodium lamps or yellow LED lighting, or an equivalent, with LED lighting being preferred over sodium. When white light is required for accurate color rendition, it should be less than or equal to 3500°, and preferably below 3000°, Kelvin color temperature (warm-white). Bluish-white lighting should not be used in permanent outdoor lighting.

Limitations: Safety and security must be considered in designing and using lighting, including the coloring of that lighting. Further of note, lighting that is amber or warm-white in color sometimes requires a special order from lighting manufacturers.

6. Minimize Lighting Usage during Construction and Operations

Project Phase: Construction, Operations

Consistent with safety requirements, lighting use should be minimized during construction and operations.

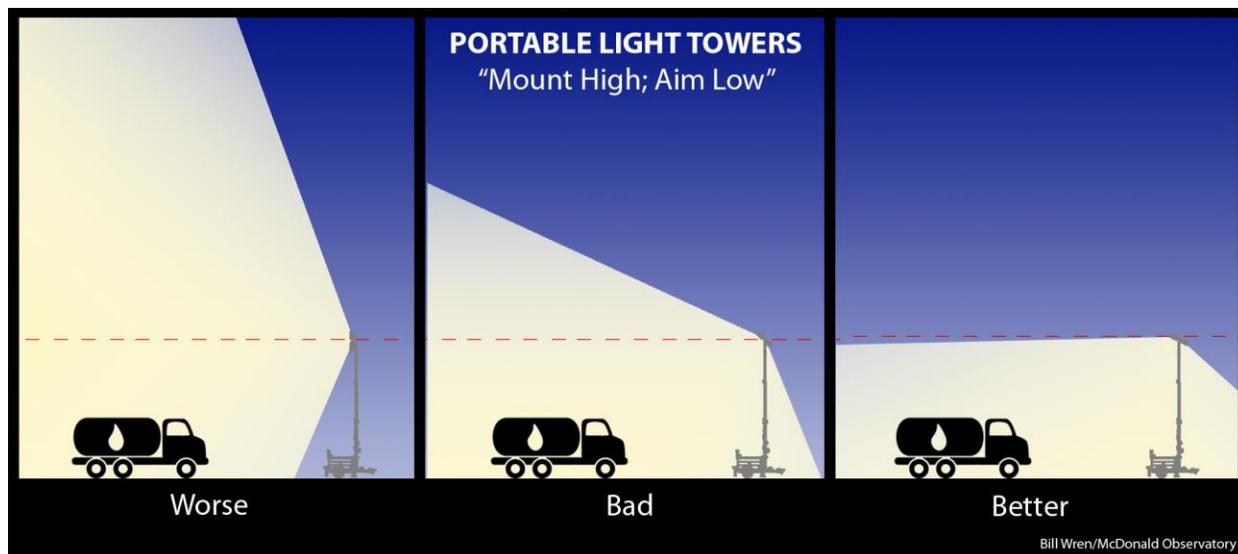
During construction, localized and portable lighting should be used where and when the work is occurring. Lighting should be powered by generators or electrical distribution when available and have switches to cut power when lighting is not required during construction.

Lighting for facilities should not exceed the minimum number, intensity, and coverage required for safety and basic security. All area lighting should be divided into separately controlled zones to focus lighting on smaller areas where tasks are being performed and to avoid illuminating unused space. Area lighting should be controlled by timers, sensors, or switches available to facility operators; dusk-to-dawn lighting controlled by photocell alone should not be allowed except where required for safety. The facility operators should identify those components/structures that do not require continuous lighting for safety reasons. Area lights should only be switched on when there is a specific need (e.g., persons occupying an area, or alarm situation). When not needed, lights should be switched off. Exceptions to switched-off lighting for safety purposes should be articulated in the lighting plan (see PBPA RLP 1 above). Focused task lighting, portable light towers, or flashlights should be used instead of area lighting, and retro-reflective or luminescent markers should be used in lieu of permanent lighting where feasible.

Limitations: Safety and security must be considered in designing and using lighting. The FAA, OSHA, and other agencies may have regulations governing lighting practices that must be considered in designing facility lighting and regulating lighting usage.

7. Use Vehicle-Mounted Lights or Portable Light Towers for Nighttime Maintenance Activities

Project Phase: Operations



Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for nighttime maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and sky glow.

Limitations: Use of vehicle lighting must be consistent with safety requirements. Some maintenance activities may have lighting requirements that make vehicle-mounted lighting impractical.

8. Options if the Need to Flare Arises

Project Phase: Operations

Limiting light emitted by flaring is an element that could have a significant positive impact on fugitive lighting, and have a fairly minor commercial impact on operations. Thus, it is recommended that locations with a continuous or near-continuous flare consider utilizing an enclosed combustor or similar technology rather than an open flare, where technically and commercially viable. While the top of an enclosed combustor is open, the light emitted from a combustor versus an open flare is dramatically less.

Limitations: Safety and security must be considered in designing and using an enclosed combustor. The EPA, Railroad Commission of Texas and other agencies may have regulations governing practices that must be considered in utilizing an enclosed combustor.