

## Lighting Plan for Bradwood Landing LNG Terminal

The lighting plan for Bradwood Landing LNG terminal is developed in accordance with recommendations of ANSI/IESNA Recommended Practice for Industrial Facilities, RP-7-01, and is based on three principles:

1. **Quality, Quantity and Safety:** LNG terminals involve safety-critical operations. A good visual environment is essential for this purpose. Design of the lighting system thus requires determination of the appropriate lighting level for the performance of various tasks and safety of operations. Lamps and fixtures, as also the cables and conduits, for Bradwood Landing are selected in conformance with the requirements of hazardous Area classification Class and Division of the various locations on the terminal. Additional factors considered in the LNG terminal lighting system design included uniform luminance and accurate color rendering. These factors lead to operational ease and safety, for example, ability to identify colors used to highlight possible hazardous situations.
2. **Environmental; Protection and Preservation:** To protect the environment from lighting pollution, undesirable effects, such as glare from the lighting fixtures and lamps, or indirectly from reflections, should be avoided. Bradwood Landing LNG has explicitly considered mitigation of lighting pollution in the lighting system design. For example, at sites where high levels of luminance are required, the design has substituted a larger number of lower wattage lamps to reduce individual lamp brightness. The VCP (Visual Comfort Probability) rating of all selected lamps and fixtures at Bradwood Landing LNG Terminal is above 70.
3. **Energy Conservation:** Bradwood Landing LNG Terminal's lighting system has been designed in accordance with the company policy of resource conservation. The design has therefore implemented many of the recent technology improvements. For example, the design uses the newer pulse start metal halide or high pressure sodium lamps and T8 and compact fluorescent lamps for all high intensity discharge applications.

## Security Lighting

Security Lighting at Bradwood Landing terminal conforms to the requirements of the Code of Federal Regulations, 49CFR 193, Section, 193.2911, Security Lighting, Section 193.2905, Protective Enclosures, and Section 149.2913, Security Monitoring.

In accordance with the requirements of Section 193.2905 of the Code of /Federal Regulations, Bradwood Landing LNG terminal has designated the following terminal facilities as security sensitive:

1. LNG storage tanks
2. Impounding system

3. Vapor barriers
4. Cargo transfer systems
5. Process and vaporization equipment
6. Control rooms and stations
7. Control systems
8. Fire control systems
9. Security communications systems, and
10. Alternative and back-up power system.

The designated facilities are provided with protective secure enclosures and the protective enclosures and the area around each facility are continuously monitored for unauthorized presence. To facilitate additional security monitoring by visual observation, as specified in Section 193.2903(a), Security Procedure, appropriate lighting to illuminate the designated facilities and the protective enclosures is provided. Light bulbs and fixtures for security lighting at Bradwood Landing are of high efficiency and environmental friendly design. These lighting sources are appropriately shielded and lensed and designed to provide a minimum of 22 Lux of light intensity on all illuminated areas from sunset to sunrise.

**Lighting for Terminal Facilities, including, LNG Reception, Storage, Vaporization, natural Gas conditioning and Disposition:**

Table 1: illumination Level for Specific Areas, presents the lighting level requirements for safe operation of the Bradwood Landing LNG terminal. The specified minimum light intensities are determined in accordance with the state-of-practice industry standards as specified in ANSI/IESNA RP-07-01.

**Table 1: Illumination levels for specific areas:**

LOCATION	INTENSITY (lux)	INTENSITY (fc)
Aircraft obstruction lighting	(See Note 3)	(See Note 3)
Administrative building		
Hallways, interior stairways, service areas	216	20
Offices, first aid, drafting areas	755	70
Berth area when not unloading a ship	22	2
Berth area when unloading a ship	216	20
Building entries and entrance stairways	54	5
Cafeteria	539	50
Compressor house	323	30
Control house		
Control room (front and back of panel)	539	50
DCS computer room	539	50
Emergency exit/entry lighting	32	3
UPS room	323	30
Equipment area	54	5
Gage glasses (at eye level)	54	5
Gate house, entrance gate and inspection	323	30
Heat exchangers	54	5
Laboratories and office	539	10
Mechanical equipment and other service areas	216	20
Instrument Shops	539	50
Machine shops	323	30
Main roads and parking lots	22	2
Outdoor pump areas	108	10
General illumination	11	1
Pump rows, manifolds, frequently used valves	216	20
Transformer areas and switchyards	108	10
Stairways and operating areas	54	5
Switchgear, MCC and battery rooms	323	30
Tank farms, stairs and gauging area	11	1
Toilet, locker rooms, showers	108	10
Walkways and platforms, process areas	32	3
Warehouses and storage buildings	54	5
Perimeter Fence	22	2

**NOTES:**

1. Lighting intensities are measured at 30 inches above floor level. A maintenance factor of 0.7 is used to calculate these intensities.
2. Utility areas are considered as process areas for lighting intensity purposes.
3. Refer to applicable local FAA regulations.

## **General Requirements**

Lighting fixtures are spaced to provide uniform intensity on the working surfaces.

Lighting fixtures are selected so that they are suitable for the particular Electrical Hazard Class and Division of the location in which they are installed. Vapor tight gaskets, diffusers and lenses are used to meet safety requirements.

Lighting is arranged so that the failure of one fuse or phase of a distribution board does not result in the loss of all illumination in an area.

Aircraft warning lights are installed in accordance with Federal Aviation Administration (FAA) guidelines and local regulations.

A maintenance factor of 85 percent is used in design calculations and the lumen output of lamps shall be the "average through life" value.

Details of the lighting plan for the specific facilities are presented below.

## **Plant Lighting**

General lighting of outdoor open areas, associated roads and access ways and on the berth is provided by pulse-start metal halide, high pressure sodium lamps or compact fluorescent lamps in fixtures that use multiple lamps. The fixtures are mounted on masts or off structural supports. All lighting fittings are supplied with integral control gear.

Lighting fixtures in process plant areas are solidly fixed and not suspended by means of items such as chains and conduits. They are mounted such that routine operations and reasonable maintenance can be conducted with safety and without the use of temporary scaffolding.

High intensity area floodlights in area with height not less than 25 feet and sized for height to spacing ratio of 1.0. The fixtures are provided with diffusers, lenses and shields so as to reduce glare and lighting pollutions. Plant structures are used where possible, for mounting lighting fixtures. Where poles or masts are used, a safe access and a working platform are provided for access for relamping and servicing.

Lighting fixtures for general illumination are located as close as possible to items such as instruments and gauges so that special lighting is unnecessary.

The site area lighting is controlled by photoelectric cell with manual over-ride facility. Local lighting switches are provided in enclosed buildings or for tank lighting.

## **LNG Storage Tanks:**

High intensity discharge lighting is provided on all working platforms on the storage tanks. In addition, all ladders and access ways are illuminated for access to the platforms during any emergencies. Light fixtures and lamps are of high efficiency type, designed for safe operations as described under plant lighting.

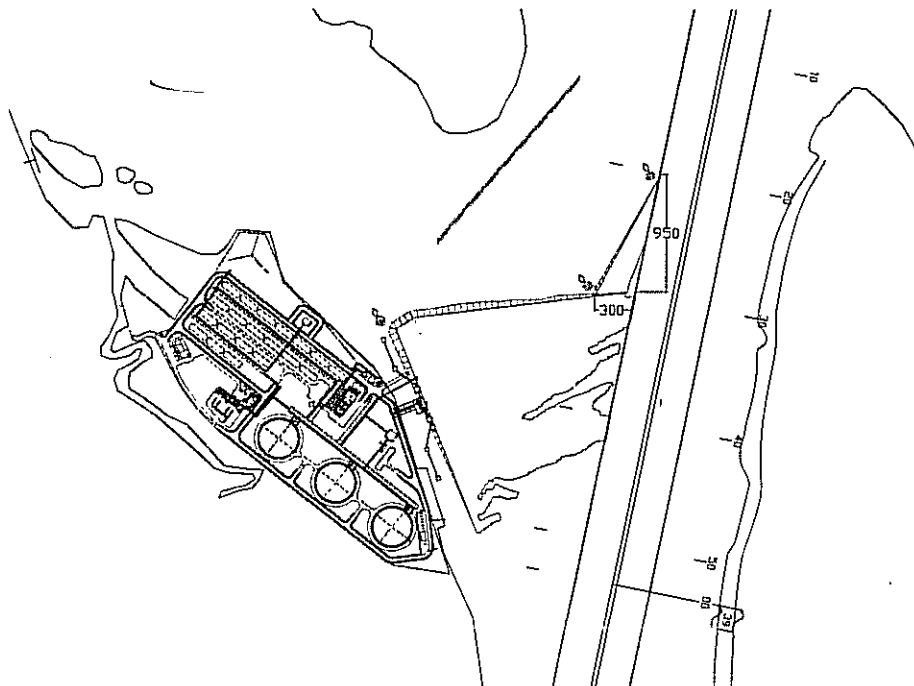
### **Road Lighting**

Road lighting is provided on all roads within the site property limits only when it is not possible to provide adequate illumination using area floodlighting. The roads that will be illuminated are those around the tanks, the process area the access road and the road to the berth. Pulse start metal halide, high pressure sodium or compact fluorescent lamps mounted on poles are used for area lighting.

### **LNG Vessel Berthing, Mooring, Turning Basin and other Marine Areas**

Lighting of appropriate intensity, as specified in Table 1: Illumination Level for Specific Areas, is provided at the vessel berth and LNG unloading platform. Pulse start metal halide, high pressure sodium or fluorescent lamps installed in fixtures with gas tight seals, as in Plant Lighting, are provided for efficient and safe vessel berthing and LNG unloading operations. The lighting fixtures are shielded and lensed to focus with uniform light distribution on the working areas.

Figure 1 below shows the marine facilities for vessel mooring and unloading of LNG at the proposed Bradwood Landing LNG terminal.



## Figure 1: LNG Vessel Berthing, LNG Reception and Other Marine Facilities

Three Day Marker buoys are provided to demarcate the vessel turning basin. While not specifically required by the Coast Guard, low intensity lighting, visible up to 1000 meters from the buoy location, will be provided to enhance safety of night operations related to vessel docking and undocking.

### **Perimeter Lighting**

Perimeter lighting is provided using compact fluorescent design lamps and fixtures with multiple lamps. Light intensities for perimeter lighting will conform to the ANSI/IESNA specifications as stated in Table 1: Illumination Levels for specific areas. Lighting fixtures will be area floodlight design and mounted on poles. Lighting fixtures will be shielded to mitigate lighting pollution and lensed to provide uniform distribution of light that is focused on the perimeter fence and areas inside of the terminal perimeter

### **Emergency Lighting:**

Emergency lighting is provided via the UPS system for the Central Control Room. Approximately 25 percent, of light fixtures are connected to the UPS. The remaining light fixtures in these areas is connected to the essential power bus, backed-up by the emergency diesel generator. Lighting fixtures with integral battery back-up power, sized for 30 minute back-up, are provided for the following areas:

- Storage tank access stairs
- Stairs and ladders in process area, where necessary for normal operations at night
- Exit lights in all buildings
- Light fixtures in all buildings, limited amount, approximately 25 percent.

### **Building Interior Lighting**

Lighting for control room instrument panels and similar installations is designed to illuminate the vertical panel with glare free uniform intensity. Twin and quad tube and compact fluorescent lamp fixtures are used for lighting system. Computer screens and other reflective viewing surfaces are installed away from windows or high lumen output fixtures.