APPENDIX O LIGTHING PLAN

ALASKA LNG

LIGHTING PLAN

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Plan Status

The following Alaska LNG Project (Project) *Lighting Plan* has been developed to provide a general overview of proposed construction and operation lighting. The exact number and placement of light fixtures is not yet known; therefore, the amount of light they would cast and the area they would illuminate would not be available until construction or as part of the permanent facilities' final design.

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1.0 INTRODUCTION

This draft *Lighting Plan* (*Plan*) identifies measures to be taken by the Project entity and its construction contractor(s) to focus light where needed, and reducing stray light (i.e., follow a path other than intended), as practicable. The *Plan* also includes a description of the permanent lighting that would be installed at the aboveground facilities. Due to seasonal changes in the photoperiod (i.e., the interval in a 24-hour period during which there is exposure to light) and differences in construction mode across Alaska [see Table 1]), supplemental lighting would be needed during some times of the year. The goal of this *Plan* is to provide adequate lighting for the prevention of accidents and compliance with Occupational Safety and Health Administration (OSHA) requirements while reducing visible light disturbance to the public and wildlife, as practicable, and reduce the potential for light radiation, including backscatter into the sky.

Table 1

Difference in Daylight Hours Across Alaska

Location	Sunrise	Sunset	Daylight Hours
Summer Solstice (June 21st)			
Barrow	May 10	August 2	84 days continuous
Fairbanks	1:59 am	11:48 pm	21:49
Anchorage	3:21 am	10:42 pm	19:21
Juneau	3:51 am	10:09 pm	18:18
Ketchikan	4:04 am	9:33 pm	17:29
Winter Solstice (December 21)			
Barrow	N/A	N/A	0:00
Fairbanks	10:59 am	2:41 pm	3:42
Anchorage	10:14 am	3:42 pm	5:28
Juneau	9:46 am	4:07 pm	6:21
Ketchikan	9:12 am	4:18 pm	7:06

Impacts from operational lighting are anticipated to be reduced in geographic extent and scale from that of construction lighting. Construction lighting impacts could occur during the shoulder season of construction, during winter construction, and during inclement weather events.

1.1 REGULATORY FRAMEWORK

Lighting for construction and operations would meet OSHA requirements when visibility is reduced based on the photoperiod.

Lighting would also meet minimal lighting regulatory and code requirements, including:

- American Petroleum Institute 540, Recommended Practice for Electrical Installations in Petroleum Processing Plants; and
- U.S. Department of Transportation (USDOT) Federal Aviation Administration (FAA) Advisory Circular AC 70/7460-1L Obstruction Marking and Lighting.

Specific to the Liquefaction Facility:

- 33 Code of Federal Regulations (CFR) Part 127, Navigation and Navigable Waters – Waterfront Facilities Handling LNG and LHG;
- 33 CFRs Part 62 and 66, Private Aids to Navigation;
- 49 CFR Part 193, Liquefied Natural Gas (LNG) Facilities: Federal Safety Standards; and
- National Fire Protection Association 59A (2016 edition), Section 8.8.2, Standard for the Production, Storage, and Handling of Liquefied Natural Gas.

In addition, local ordinances would be met, as applicable. Additional lighting requirements could also apply based on other permit conditions or regulatory agency stipulations.

2.0 LIQUEFACTION FACILITY

The following section outlines the proposed lighting plan for construction and operation of the Liquefaction Facility, which includes both the LNG Plant and Marine Terminal.

2.1 CONSTRUCTION

Construction-related lighting would be installed at the start of construction and operate as required to maintain a safe working area. Temporary lighting would also be needed to facilitate construction activities at times when natural light levels are insufficient. This would include onshore work as well as lighting for work over and within the water (e.g., dredging, pile driving).

High mast lighting would typically be used for area lighting for safe construction. To avoid or reduce lighting effects during construction, localized task lighting would also be used when possible. It is currently anticipated that construction contractors would use portable light towers with integrated generators. Light towers would be adjustable so that the height and direction could be altered for site-specific situations. Work-task lighting would be directed and shielded to illuminate the work areas while meeting minimum safety requirements, and to avoid/prevent excess lighting from extending outside the working footprint, including over and within water work areas. Light fixtures would be provided with diffusers, lenses, and shields so as to reduce glare and light radiation, including backscatter into the sky, as is practicable. In addition to illuminating areas during construction activities, light towers would be positioned adjacent to construction roads at critical locations, such as at intersections or significant bends, to ensure safe movement of vehicles.

2.1.1 Working Over and Within the Water

Lights for working over and within the water would typically be concentrated on the decks of work vessels for marine work, and would typically include illuminating pile driving rigs and lifting cranes. Lighting would also be used for the work along the product loading facility trestle, and would be used primarily to illuminate areas where people would be working. There would typically be no need to shine lights offsite (i.e., beyond the work area). However, depending on the light type, there could be indirect radiation of some light away from the work area. In addition, marker buoys with U.S. Coast Guard (USCG) required lighting to provide aid to navigation would be provided as necessary.

2.1.2 Camps

In addition to interior lighting at the temporary construction camp, lighting would include area lighting for roads access, parking, and bus loading. Work lighting would be required for food unloading, stairs, and doorways.

2.2 OPERATIONS

Generally, the Liquefaction Facility would need lighting for plant operations, perimeter security, access, and emergencies. During operations, lights would be used to illuminate work spaces and to ensure the safety and security of Liquefaction Facility structures and operations, including the Marine Terminal.

The exact number and placement of light fixtures is not yet known; therefore, the amount of light they would cast and the area they would illuminate would not be available until final design. However, key areas of lighting at the Liquefaction Facility would include:

- LNG Plant exterior areas (anticipated to be LED due to anticipated reduced cost and longer life span).
- Storage tanks (high efficiency) - No illumination would be used for the outer surface of the vertical concrete walls of the tanks. Aviation lights, stair lights, and platform lights are required.
- Stacks (including flare, turbine exhaust, and any required aviation lighting).
- Tall equipment.
- Product Loading Facility, including marker buoys with USCG required lighting to provide aide to navigation.
- Perimeter and security lighting (250-watt LED).
- Emergency lighting in strategic areas.
- Building interior lights.

Liquefaction Facility lighting would meet regulatory requirements, codes, and standards for lighting for overall site operations/maintenance, safety, and security. Minimal requirements and guidelines are listed in Section 1.1 of this document. This includes USDOT FAA Advisory Circular AC 70/7460-1L Obstruction Marking and Lighting, which states that any temporary or permanent structure, including all appurtenances that exceed an overall height of 200 feet, should normally be marked and/or lighted (FAA, 2015). The exact requirements are determined following an FAA aeronautical study; lighting or marking may reveal that the absence of marking and/or lighting will not impair aviation safety. The aeronautical study would determine what lighting is necessary, including aviation warning lighting. The warning lighting installed for the Project would be at least the minimum required intensity to meet the current FAA-recommended marking and/or lighting.

For safety and security reasons, lighting would be active throughout the entire Liquefaction Facility during low-light conditions. In addition, during LNG carrier loading operations, overwater lighting would be required at the Marine Terminal.

To minimize the potential for impacts related to artificial lighting, the Liquefaction Facility's lighting design would include light reduction techniques including the use of directed lighting, timers, and motion sensors where appropriate to avoid lighting during times of non-use. For example, tilted lights (e.g., bracket and stanchion mounted lights) would be directed toward the center of the facility to minimize stray light. In addition, hoods would be specified where possible for lights on the facility exterior (except for navigation aids and security lights) to focus light where needed for operational purposes while minimizing stray light.

3.0 INTERDEPEDENT PROJECT FACILITIES

Lighting for the Interdependent Project Facilities (i.e., Mainline, GTP, PBTL, PTTL, and associated facilities) would meet regulatory requirements, codes, and standards for safety and security.

3.1 CONSTRUCTION

Area lighting would be used as necessary for safe construction. To avoid and minimize lighting effects during construction, localized task lighting would also be used when possible, as described in Section 2.1.

3.1.1 Pipelines

Lighting requirements would vary depending on contractor needs, which cannot be fully ascertained at the present time due to the dynamic nature of this type of construction. Work-task lighting would be directed and shielded to illuminate the work areas and meet safety requirements, as well as to avoid/prevent excess lighting from spilling outside the immediate working footprint. Contractors would follow best management practices to determine what is effective and safe. Only limited, discrete portions of the pipeline construction right-of-way would need to be lit at any one point in time.

3.1.1.1 Working Over and Within the Work

While constructing the offshore portion of the Mainline across Cook Inlet, lights would typically be mounted on the vessels used for the work, and would be used primarily to illuminate areas where people would be working. There would typically be no need to shine lights directly into the water or offsite, with pile driving or crane operations being an exception. Another exception would be lighted markers (buoys), as well as lighting installed along the shoreline to support nearshore work.

3.1.1.2 Camps

Lighting for temporary construction camps would be similar to that for the Liquefaction Facility temporary camp discussed in Section 2.1.2.

3.1.2 Gas Treatment Plant (GTP)

Similar to the Liquefaction Facility, construction related lighting for the Gas Treatment Plant (GTP) would be installed at the start of construction and operate as required to maintain a safe working area. Temporary lighting would also be needed to facilitate construction activities at times when natural light levels are insufficient. To avoid or reduce lighting effects during construction, localized task lighting would be used when possible, as described in Section 2.1.

3.1.2.1 Working Over and Within the Water

At West Dock, temporary lighting would also be needed to facilitate construction activities at times when natural light levels would be insufficient. This would include work over and within the water (e.g., screeding, pile driving). Away from the shoreline, lights for work over and within the water would typically be mounted on the vessels used for the work, and would be used primarily to illuminate areas where people would be working. There would typically be no need to shine lights

offsite. However, depending on the light type, there could be indirect radiation of some light away from the work area.

The temporary barge bridge would have USCG required lighting to provide aide to navigation.

3.1.2.2 Camp

Lighting for the Integrated Operations and Construction Camp would be similar to that for the Liquefaction Facility temporary camp discussed in Section 2.1.2.

3.2 OPERATIONS

To minimize the potential for impacts related to artificial lighting during operations, the lighting design would include light reduction techniques, including the use of directed lighting, timers, photocell controls, and motion sensors, where appropriate, to avoid unneeded lighting during times of non-use.

The exact number and placement of light fixtures is not yet known for the Interdependent Project Facilities; therefore, the amount of light they would cast and the area they would illuminate would not be available until final design. However, key areas of lighting at the Interdependent Project Facilities are described in the following sections.

3.2.1 Pipeline Aboveground Facilities

Generally, Pipeline Aboveground Facilities would need lighting for station operations (compressor and heater stations), perimeter security, site access, and emergency lighting. Key areas of lighting at the Pipeline Aboveground Facilities would include:

- Compressor station building exterior;
- Communication tower;
- Entry/exit points;
- Building interior lighting; and
- Emergency lighting in strategic areas.

Outdoor lighting would be limited during unmanned operations to the minimum amount required for security; however, lighting would be active around the perimeter fence during low-light conditions.

3.2.2 GTP

Generally, the GTP would need lighting for plant operations, camp operations, perimeter security, site access, and emergency lighting. Key areas of Project lighting at the GTP would include:

- GTP pad (e.g., outdoor – high pressure sodium);
- Onsite integrated construction and operations camp;
- Communication tower (per local requirements or International Civil Aviation Organization);
- Stacks (per FAA);
- Entry points;
- Lighting at the reservoir and other off-pad areas;
- Flares (per FAA);

- Emergency lighting in strategic areas (rapid start fluorescent, incandescent or LED); and
- Building interior lighting (e.g., metal halide).

For security and safety reasons, lighting would be active throughout the entire operation and camp pads during low-light conditions.

4.0 LITERATURE CITED

U.S. Department of Transportation (USDOT) Federal Aviation Administration (FAA). 2015. USDOT FAA Advisory Circular AC 70/7460-1L (Issued December 4, 2015). Available online at: https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.current/documentNumber/70_7460-1

5.0 ACRONYMS AND TERMS

Term	Definition
CFR	Code of Federal Regulations
FAA	Federal Aviation Administration
GTP	Gas Treatment Plant
LNG	Liquefied Natural Gas
OSHA	Occupational Safety and Health Administration
Plan	Draft Lighting Plan
Project	Alaska LNG Project
USCG	United States Coast Guard
USDOT	United States Department of Transportation