NFEnergía LLC

San Juan Micro-Fuel Handling Facility

Resource Report 11
Reliability and Safety

Draft

Docket No.
CP21-___-000

September 15, 2021

NFEnergía LLC
SAN JUAN MICRO-FUEL HANDLING FACILITY
RESOURCE REPORT 11—RELIABILITY AND SAFETY

Minimum Filing Requirements for Environmental Reports:	Addressed in Section:
Describe how the project facilities was designed, constructed, operated, and maintained to minimize potential hazard to the public from the failure of project components as a result of accidents or natural catastrophes. (§380.12(m)).	Section 11.4
Provide plot plan drawings of impoundments with cross-sections showing elevations.	Resource Report 13, Appendix S.3
Design spills for liquefied natural gas ("LNG") storage tanks, marine transfer lines, sendout, and process areas in accordance with Table 2.2.3.5 in the 2001 version of National Fire Protection Association ("NFPA") 59A: Standard for the Production, Storage, and Handling of Liquefied Natural Gas (NFPA 59A).	N/A—Small Scale Facility according to NFPA 59A
Provide meteorological data supporting the wind speed, atmospheric temperature, and humidity used in all hazard analyses. Also, provide the source of the weather data.	N/A—Small Scale Facility according to NFPA 59A
Provide plot plans clearly delineating the entire facility property line as well as the thermal radiation and flammable vapor dispersion exclusion zones. Sufficient data and drawings corroborating the applicant's exclusion zone calculations should be included.	N/A—Small Scale Facility according to NFPA 59A
Provide flammable vapor dispersion calculations which are supported drawings indicating the size and location of the line proposed from the design spill.	N/A—Small Scale Facility according to NFPA 59A
Provide flammable vapor dispersion calculations which are supported by plan, profile, and cross-section drawings showing the dimensions and configuration of the proposed containment system.	N/A—Small Scale Facility according to NFPA 59A
Provide flammable vapor dispersion calculations which are supported by source strength calculations.	N/A—Small Scale Facility according to NFPA 59A
Provide flammable vapor dispersion calculations which are supported by DEGADIS program output and results.	N/A—DEGADIS not used
Provide flammable vapor dispersion calculations which are supported by a drawing clearly delineating the property line and the resulting exclusion zone.	N/A—Small Scale Facility according to NFPA 59A
Describe Agency Coordination regarding the Emergency Response Plan.	Section 11.4.13
Identify all active military installations which may be impacted by the operation of the proposed facility or by LNG vessel transit.	Section 11.1.1.7
Provide copies of the Letter of Intent submitted to the United States Coast Guard ("USCG").	Section 11.2.3
Submit a preliminary waterway suitability assessment to the USCG in accordance with the USCG's Navigation and Vessel Inspection Circular 05-05.	Section 11.2.3
Provide an analysis that addresses current commercial and recreational waterway traffic and the impact of LNG vessels (address and analyze vessel traffic congestion issues).	Section 11.2.3
Simulation and modeling studies should take into account various scenarios that include: tides, currents, winds, ice, passing vessels direction, passing vessels sizes, and LNG vessel sizes.	Section 11.2.3 and Appendix 11B
Location of High Consequence Areas crossed by and adjacent to the proposed pipeline route.	N/A—no DOT pipeline
U. S. Department of Transportation's class locations for off-site pipeline portion by milepost.	N/A—no DOT pipeline

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RESOURCE REPORT 11—RELIABILITY AND SAFETY

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ACRONYMS AND ABBREVIATIONS

ASME	American Society of Mechanical Engineers
BP	bollard pull
CAA	Clean Air Act
CFR	Code of Federal Regulations
COTP	Captain of the Port
DOT-PHMSA	United States Department of Transportation, Pipeline and Hazardous Materials Safety Administration
ERP	Emergency Response Plan
ESD	emergency shutdown
^{o}F	degrees Fahrenheit
F&G	Fire & Gas
FERC	Federal Energy Regulatory Commission
FSP	facility security plan
FSU	floating storage unit
gal	gallon
GCU	gas combustion unit
lb/ft^3	pounds per cubic foot
LNG	liquefied natural gas
LOR	Letter of Recommendation
m^3	cubic meter
MFH Facility	San Juan Micro Fuel Handling Facility
mm Hg	millimeter of Mercury
mt	metric ton
NEPA	National Environmental Policy Act
NFEnergía	NFEnergía LLC
NFPA	National Fire Protection Association
NVIC	Navigation and Vessel Inspection Circular
PREPA	Puerto Rico Electric Power Authority
psig	pounds per square inch gauge
SIS	Safety Instrumented System
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
WSA	Waterway Suitability Assessment

NFEnergía LLC
SAN JUAN MICRO-FUEL HANDLING FACILITY
RESOURCE REPORT 11—RELIABILITY AND SAFETY

11.0 RESOURCE REPORT 11—RELIABILITY AND SAFETY

NFEnergía LLC ("NFEnergía") is seeking authorization from the Federal Energy Regulatory Commission ("FERC") under Section 3 of the Natural Gas Act to continue operating the San Juan Micro-Fuel Handling Facility ("MFH Facility"), a liquefied natural gas ("LNG") import and regasification facility. The MFH Facility is located on approximately 6.1 paved and fenced acres of an industrial area at Wharves A and B of the Puerto de San Juan (Port of San Juan), Puerto Rico, which is situated among existing industrial uses in the north of Puerto Rico where it can supply power generation sources serving nearby load centers using minimal additional infrastructure. To operate the MFH Facility, "pocket-sized" LNG vessels (also called "shuttle vessels") bring LNG into the San Juan Harbor where the LNG is transferred from the shuttle vessel to a non-jurisdictional floating storage unit ("FSU") vessel that is semi-permanently moored adjacent to the MFH Facility site. The FSU transfers LNG onshore where certain quantities remain liquefied and are transloaded onto trucks for over-the-road delivery to end users and certain quantities are regasified and made available to Units 5 and 6 of the adjacent San Juan Power Plant via a 75-foot long, 10-inch diameter segment of power plant piping. The MFH Facility has a regasification capacity of 130 million standard cubic feet per day and a truck loading capacity of 87.52 million standard cubic feet per day.

NFEnergía initially developed the MFH Facility to serve its commercial customers via a truck loading operation for distribution of LNG for regasification and use at behind-the-fence power generation facilities across Puerto Rico—typically multinational companies with manufacturing operations. In July 2018, Puerto Rico Electric Power Authority ("PREPA") issued a request for proposals to retrofit Units 5 and 6 of the San Juan Power Plant to enable dual-fuel capability and to supply PREPA with natural gas. NFEnergía participated in that competitive process and was chosen as the successful bidder. PREPA and NFEnergía entered into a contract to effectuate the award in March 2019, and the MFH Facility began operating in March 2020 and became fully operational in May 2020.

FERC's National Environmental Policy Act ("NEPA") review process requires that an applicant submit an Environmental Report consisting of up to 13 individual resource reports. This resource report is consistent with and meets or exceeds all applicable FERC filing requirements. A checklist showing the status of FERC's filing requirements for Resource Report 11 (18 Code of Federal Regulations ["CFR"] § 380.12) is included before the table of contents.

Resource Report 11 provides a description and supporting information regarding the reliability and safety of the MFH Facility. This report describes the design, operation, and maintenance measures intended to maximize project reliability and minimize potential hazards to the public from intentional acts or failure of project components as a result of accidents or natural catastrophes. It includes a summary of potential hazards, measures to protect the public, design features of the facilities as they relate to reliability and safety, procedures for operation and training, and coordination with local fire, police and medical resources. Resource Report 11 complements and is closely tied to Resource Report 13, which provides specific technical details on engineering, design, and materials.

NFEnergía initially developed the MFH Facility to serve its commercial customers via a truck loading operation for distribution of LNG for regasification and use at power generation facilities across the Island. In mid-2018, PREPA issued a request for proposals to retrofit Units 5 and 6 of the San Juan Power Plant to enable dual-fuel capability and to supply PREPA with natural gas. NFEnergía participated in that competitive process and was chosen as the successful bidder. PREPA and NFEnergía entered into a contract to effectuate the award in March 2019 and the MFH Facility began commercial operations in May 2020.

The major facilities at the MFH Facility are summarized below:

- LNG vaporization packages;
- LNG unloading and forwarding packages;
- Four-bay truck loading facility; and
- Buffer tanks to support the vaporization and truck loading operations.

Peripheral facilities and structures include the following:

- Ground flare/gas combustion unit ("GCU");
- Boil-off gas compressor;
- Control room;
- Backup diesel generator;
- Utility area;
- Miscellaneous piping and racks;
- LNG impoundment trough and basin;
- Fire and gas detection system;
- Fire suppression system;
- Parking areas;
- Plant roads;
- Security perimeter fencing; and,
- Security lighting and monitoring equipment.

A detailed description of the MFH Facility and its operation and maintenance procedures is included in Resource Reports 1 and 13. The MFH Facility and its regional location are illustrated in the figures contained in appendices to Resource Report 1.

LNG import facilities and associated infrastructure serve a critical gas supply function requiring a high level of security and reliability. These facilities must be designed to minimize hazards extending beyond the property limits, which could pose a risk to the public. Both safety and reliability are demonstrated through prudent design, appropriate equipment selection, careful construction and competent operation and security protocols. Both safety and reliability of operation can be evaluated using the following traditional concepts:

- Hazard is any activity, procedure, plant, process, substance, situation or any other circumstance that could cause, or contribute to causing, a major incident;
- Risk is the sum of the mathematical product of the probability of incidents and the magnitude of the consequences of an incident; and
- Unreliability is the sum of the mathematical product of the probability of malfunctions and the impact on system performance due to such malfunctions.

NFEnergía's approach for the MFH Facility is to minimize both probability and effects of safety incidents and malfunctions. This approach was implemented throughout MFH Facility design, construction, and operation. The initial step is to recognize potential hazards and malfunctions. This was undertaken in the design of the MFH Facility, as described in detail in this Resource Report 11.

The MFH Facility was designed, and is operated and maintained, in accordance with all applicable laws, regulations, codes, standards, and generally recognized practices applicable to the LNG industry. Complete listings of applicable requirements for all facilities are provided in Resource Report 13.

11.1 Regulatory Oversight

11.1.1 Regulatory Oversight of Reliability and Safety

Multiple federal agencies share regulatory authority over the operation of the MFH Facility.

11.1.1.1 Federal Energy Regulatory Commission

FERC authorizes the operation of LNG terminals under Section 3 of the Natural Gas Act. FERC is the lead agency for evaluating compliance with NEPA for LNG facilities. FERC requires standard information to be submitted to perform safety and reliability engineering reviews for LNG facilities.

11.1.1.2 United States Department of Transportation - Pipeline and Hazardous Materials Safety Administration

The United States Department of Transportation, Pipeline and Hazardous Materials Safety Administration ("DOT-PHMSA") specifies minimum federal safety standards for LNG facilities under its jurisdiction in 49 CFR Part 193. However, the MFH Facility does not fall under the jurisdiction of DOT-PHMSA.

11.1.1.3 United States Coast Guard

The United States Coast Guard ("USCG") has authority over the safety of an LNG facility's marine transfer area and LNG marine traffic, as well as over security plans for the entire LNG facility and LNG marine traffic. The USCG regulations applicable to LNG facilities are codified in 33 CFR Parts 105 and 127. The USCG is a cooperating agency in the permitting process for LNG facilities with FERC when there are marine facilities present. As defined in 33 CFR § 127.007 and 18 CFR § 157.21, USCG requires applicants to submit a Letter of Intent, Preliminary Waterway Suitability Assessment ("WSA") and a Follow-on WSA to the Captain of the Port ("COTP"). The WSA is USCG's review of the marine transportation component of an LNG project and addresses the suitability of the waterway for additional LNG carrier marine traffic. The regulations require that full consideration be given to safety and security of the port, the waterway, the vessels transporting LNG, and the LNG carrier at berth.

In February 2004, USCG and FERC entered into an Interagency Agreement to ensure greater coordination in addressing the full range of safety and security issues at LNG terminals, including terminal facilities and tanker operations, and maximizing the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. Under the Interagency Agreement, FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with LNG facility construction and operation. USCG participates as a cooperating agency and remains responsible for enforcing its regulations.

11.1.1.4 United States Environmental Protection Agency

The United States Environmental Protection Agency ("USEPA") has jurisdictional authority under the Clean Air Act of 1970 ("CAA") (42 U.S.C. § 85) to control air pollution by developing and enforcing rules and regulations for all entities that emit pollutants into the air. Under this authority, the USEPA has developed regulations for major sources of air pollution and certain source categories and has established general conformity applicability thresholds. The USEPA has delegated the some of its jurisdictional authority under the CAA to the Puerto Rico Environmental Quality Board; however, the ministerial duty of the former Environmental Quality Board now falls under the Departamento de Recursos Naturales y Ambientales (Department of Natural and Environmental Resources). CAA permitting in Puerto Rico is the shared responsibility of the Department of Natural and Environmental Resources and USEPA Region 2. The USEPA Region 2 retains the responsibility to issue and implement the Prevention of Significant Deterioration permits. See Resource Report 9 for applicable CAA provisions and jurisdictional authorities.

11.1.1.5 United States Occupational Safety and Health Administration

The MFH Facility is under the jurisdiction of the Occupational Safety and Health Organization; however, the Process Safety Management program does not apply to the MFH Facility.

11.1.1.6 United States Department of Transportation Federal Aviation Administration

The tallest structure at the MFH Facility is the ground flare, which extends approximately 45 feet above ground level. The MFH Facility is located approximately 1.86 miles across the San Juan Harbor from the Isla Grande Airport; however, there are no structures that extend outward

or upward from a slope on the project site. Given these on-site conditions, there is no requirement for NFEnergía to file a notice with the Federal Aviation Administration prior to construction of their MFH Facility structures. For the same reasons, NFEnergía does not anticipate any hazard to air travel from structures or ground flare operation during startup, shutdown, or upset conditions. Therefore, no aeronautical operations will be impacted by the MFH Facility operation or by transportation to or from the MFH Facility.

11.1.1.7 United States Department of Defense

The closest military installations are Fort Buchanan, which is approximately 1.4 miles Southwest of the MFH Facility, and the San Juan National Guard base, which is approximately 2 miles to the north. Both military installations are remote from the MFH Facility and outside of the Sandia Zone 1 for LNG transportation. Therefore, no military installations will be impacted by the MFH Facility operation or by transportation to or from the MFH Facility.

11.1.1.8 United States Nuclear Regulatory Commission

Puerto Rico does not currently have any operating nuclear power plants; the only nuclear power plant on the Island (Rincon) was never operational and is located 89 miles from the MFH Facility and not along the LNG shuttle vessel route. Therefore, no nuclear plants will be impacted by the MFH Facility operation or by transportation to or from the MFH Facility.

11.1.1.9 State and Local Agencies

NFEnergía consulted with state agencies, local agencies, and many different stakeholders at the territorial level on various topics. Results of those consultations and discussions are introduced in Resource Report 1 and discussed in greater depth in the relevant resource reports.

11.2 Hazard Identification

11.2.1 Hazardous Materials

11.2.1.1 Liquefied Natural Gas

The MFH Facility receives LNG and vaporizes it to natural gas or loads it onto LNG tanker trucks. Therefore, no refrigeration or liquefaction facilities are present.

LNG is natural gas in its liquid state, which occurs when the gas has cooled to 260 degrees Fahrenheit ("ºF") below zero. Similar to natural gas in its vapor state, LNG is odorless, colorless, non-corrosive, and non-toxic. LNG has a density of approximately 26.5 pounds per cubic foot ("lb/ft^3") and is neither flammable nor explosive. LNG vaporizes on contact with warmer surfaces. Vapor resulting from the vaporization of LNG has a specific gravity of 1.5 and will initially behave as a liquid in that it will seek the lowest point (i.e., settle close to the ground) in the vicinity of the LNG vaporization source (i.e., a release or spill). Although LNG vapor has no odor or color, its low temperature will cause condensation of water vapor in the air, forming a visible white cloud. Cold vapor quickly becomes buoyant as it contacts the surrounding air and becomes lighter than air at approximately -100 ºF.

The inherent safety advantages of natural gas, such as buoyancy, low reactivity, and high ignition temperature, can be partially offset by the large storage volumes and low storage

temperature of the LNG. The principal hazards associated with LNG result from its cryogenic temperature (-260°F), the flammability of natural gas vapors, the dispersion characteristics of the natural gas vapors, and potential loss of containment during catastrophic events.

Due to its cryogenic temperature, LNG spills, if touched by human skin, could result in frostbite and injuries to anyone who comes into contact with it. In addition, brittle fracture and structural damage could occur if LNG spills were to contact materials incompatible with cryogenic temperatures. Unlike heavier hydrocarbons such as propane, natural gas and LNG do not have the potential for the explosion of unconfined vapor clouds. However, while LNG in its liquid state is not flammable, LNG vapors resulting from a release or spill are flammable at molar concentrations of 5-15 percent gas in air. Initial vaporization following a release of LNG produces a flow of high concentration vapor, too rich in fuel to burn. As the cloud spreads, it is mixed with air and begins to warm and dilute. A relatively narrow region near the outer edges of the cloud will have flammable concentrations; beyond this region, the gas cloud is too diluted ("lean") and therefore non-flammable. The distance the flammable cloud travel depends on many variables, including the volume of the initial release or spill, its duration, the wind velocity and direction, terrain, and atmospheric temperature and humidity. Although LNG is non-toxic, LNG vapors at high concentrations can displace oxygen, resulting in oxygen levels that are too low for safe human exposure. Thus, if a person were to enter a high LNG vapor concentration area resulting from a LNG spill, asphyxiation could result. During design, NFEnergía ensured that these high concentration areas would be limited to the MFH Facility.

The following table summarizes the properties of methane.

Table 11-1: Properties of Methane.

Property	**Value**			**Notes**
Melting temperature	-296 °F [a]			
Boiling temperature	-258.7 °F [a]			at 760 mm Hg
Flash point	-306 °F			Closed cup
Lower flammability limit	5.3% [a]			In air by% volume
Upper flammability limit	14% [a]			In air by% volume
Auto-ignition temperature	999 °F [a]			--
Property	**Min**	**Normal**	**Max**	**Notes**
Working Volume	9,900 gal	N/A	28,050 gal	Vaporizers LNG Suction Drum
	9,000 gal	N/A	25,500 gal	Truck Loading LNG Suction Drum
Operating temperatures in process	-242 °F	Varies	116 °F	Includes LNG and natural gas.
Operating pressures in process	19.9 psig	Varies	685 psig	LNG
	14.8 psig	Varies	650 psig	Natural gas
Operating densities in process	26.55 lb/ft^3	Varies	26.65 lb/ft^3	LNG
	0.11 lb/ft^3	Varies	2.20 lb/ft^3	Natural Gas
Property	**Details**			
Asphyxiant and toxic properties	Simple Asphyxiant, non-toxic [b]			
Maximum concentration of toxic component in process	N/A			
Asphyxiation concentration	Below 18% oxygen [a]			
Corrosion rate of skin	N/A			
Corrosion rate of metal surfaces	N/A			

a https://cameochemicals.noaa.gov/chemical/3757
psig = pounds per square inch gauge
mm Hg = millimeter of Mercury
gal = gallon

11.2.1.2 Propane

The MFH Facility only uses propane as the fuel for the ground flare pilot light.

The following table summarizes the properties of propane.

Table 11-2: Properties of Propane.

Property	**Value**			**Notes**
Melting temperature	-305.9 °F [a]			
Boiling temperature	-43.8 ° F			at 760 mm Hg
Flash point	-156 °F [a]			Closed cup
Lower flammability limit	2.1% [a]			In air by% volume
Upper flammability limit	9.5% [a]			In air by% volume
Auto-ignition temperature	842 °F [a]			--
Property	**Min**	**Normal**	**Max**	**Notes**
Storage Volume	N/A	500 gal	N/A	
Operating temperatures in storage		82 °F		
Operating pressures in storage		133 psig		
Operating densities in storage		30.5 lb/ft^3		
Property	**Details**			
Asphyxiant and toxic properties	Simple Asphyxiant, non-toxic			
Maximum concentration of toxic component in process	N/A			
Asphyxiation concentration	Below 18% oxygen			
Corrosion rate of skin	N/A			
Corrosion rate of metal surfaces	N/A			

[a] https://cameochemicals.noaa.gov/chemical/9018
psig = pounds per square inch gauge
mm Hg = millimeter of Mercury
gal = gallon

11.2.1.3 Nitrogen

The MFH Facility uses nitrogen for utility purposes. Nitrogen is a non-toxic, odorless, colorless, non-corrosive, and non-flammable material. Liquid nitrogen vaporizes rapidly on contact with warmer surfaces. Nitrogen vapors at high concentrations can displace oxygen, resulting in oxygen levels that are too low for safe human exposure, potentially causing asphyxiation if a person were to enter a high vapor concentration area.

The following table summarizes the properties of nitrogen.

Table 11-3: Properties of Nitrogen.

Property	**Value**			**Notes**
Melting temperature	-354 °F [a]			
Boiling temperature	-320.1 °F [a]			at 760 mm Hg
Flash point	N/A			
Lower flammability limit	N/A			
Upper flammability limit	N/A			
Auto-ignition temperature	N/A			
Heat of combustion	N/A			
Property	**Min**	**Normal**	**Max**	**Notes**
Storage Volume	740 gal	N/A	1580 gal	

Operating temperatures in process		82 °F		Gaseous nitrogen
Operating temperatures in storage	-282.8 °F	Varies	-259.9 °F	
Operating pressures in process		100 psig		
Operating pressures in storage	100 psig	Varies	225 psig	
Operating densities in process		Varies		
Operating densities in storage	38.31 lb/ft^3	Varies	43.67 lb/ft^3	
Property	**Details**			
Asphyxiant and toxic properties	Simple Asphyxiant, non-toxic			
Maximum concentration of toxic component in process	N/A			
Asphyxiation concentration	Below 6% oxygen			
Corrosion rate of skin	N/A			
Corrosion rate of metal surfaces	N/A			

[a] https://cameochemicals.noaa.gov/chemical/8898
psig = pounds per square inch gauge
mm Hg = millimeter of Mercury
gal = gallon

11.2.1.4 Diesel

Diesel is used to fuel two emergency power generators; each emergency generator includes a diesel tank with capacity of 546 gallons. Diesel is a combustible material.

The following table summarizes the properties of diesel.

Table 11-4: Properties of Diesel.

Property	Value	Notes
Boiling temperature	540 to 640 °F [a]	at 760 mm Hg
Flash point	125 °F [a]	
Lower flammability limit	1.3% [a]	
Upper flammability limit	6% [a]	
Auto-ignition temperature	350to 625 °F [a]	
Property	**Details**	
Asphyxiant and toxic properties	Harmful if swallowed	
Asphyxiation concentration	N/A	
Corrosion rate of skin	Irritant (Category 2) [a]	
Corrosion rate of metal surfaces	Non-corrosive	

[a] https://cameochemicals.noaa.gov/chemical/11452
mm Hg = millimeter of Mercury

11.2.2 Process Hazards

11.2.2.1 Hazard Identification and Analysis

A Hazardous Operations Assessment was performed on the MFH Facility engineering design. The objective of these assessments is to perform systematic analyses to identify potential hazards, assess them, and make recommendations for mitigation during the course a project's design.

All these assessments were based on the MFH Facility's plot plan, process flow diagrams, and heat and material balances, which are included in Resource Report 13, appendix 13E. The

results and recommendations of these assessments are included in Resource Report 13, appendix 13G.

11.2.2.2 Liquefied Natural Gas

The principal hazards of LNG result from its cryogenic temperature (-260°F), flammability of vapors, potential for loss of containment, and vapor dispersion characteristics. Natural gas is one of the most desirable sources of clean energy and has an excellent safety record; however, specific aspects of LNG safety must be taken into account. The inherent safety advantages of natural gas can be partially offset by the large storage volumes, potential for releases, and low storage temperature of LNG.

Vapors resulting from the vaporization of LNG have a specific gravity of approximately 1.5 and will initially seek the lowest point near the LNG vaporization source (e.g., a release or spill). When warmed to approximately -160°F, LNG vapors become buoyant and will rise and rapidly disperse into the atmosphere. The distance that the vapors will travel depends on many variables, including the volume of the initial release or spill, its duration, the wind velocity and direction, terrain, atmospheric temperature, and humidity. Although LNG vapors have no color, the low temperature will cause condensation of water vapor in air, forming a visible white cloud.

LNG presents a low temperature hazard in the event of a loss of containment. All piping for the MFH Facility is designed for cryogenic service, and LNG process and transfer systems are designed to minimize the potential for leaks and failures. Equipment that may be in contact with pooled LNG is designed to withstand the cold contact or protected by cryogenic insulation to prevent embrittlement. A spill containment system is provided to route spills away from process equipment and to an impoundment sump. Any LNG collected in the spill containment system will warm over time and vaporize, producing a cold vapor cloud above or around the spill containment system.

The spill containment system will channel spills away from process equipment, and the impoundment sump is located away from equipment, structures, and buildings. Dry chemical systems are provided around the MFH Facility, which can be used to extinguish LNG fires, and water spray systems are provided, which can be used to cool adjacent equipment. Exceedance of the spill containment area could result in the spread of LNG to areas not designed for cryogenic temperatures. In order to mitigate this hazard, the LNG impoundment sump is sized to contain 110% of the capacity of the largest permanent vessel on-site. Even though LNG vapors, which are composed primarily of methane, have a low reactivity, the potential still exists for overpressures to be generated if a flammable LNG vapor cloud is ignited in a congested and/or confined area. The pressure wave can damage buildings, structures, and process equipment. All MFH Facility equipment is located outdoors to prevent the accumulation of gas in a confined space; additionally, congestion levels are inherently low due to the lack of complex process equipment and to the spacing between components. Therefore, overpressure hazards are considered minimal at the MFH Facility. Process overpressures are mitigated by having equipment designed in accordance with the American Society of Mechanical Engineers (“ASME”) codes and relief equipment set to activate below the equipment design pressures. Additionally, gas detection at building air intakes will shut down affected equipment. These safety measures are intended to prevent the escalation of events associated with a spill of LNG.

When a release of LNG occurs, a vapor cloud is formed that could present different fire hazards if ignited. Immediate ignition, or ignition near the source, would result in a jet fire or pool

fire that could affect nearby equipment or personnel. A flash fire could also occur if there is a delayed ignition of the vapor cloud in an open area; this can result in a brief, high heat release that could ignite secondary fires or impact nearby equipment or personnel.

Cascading events, including the failure of critical equipment or structures, may introduce a hazard into the MFH Facility. However, the mitigation features presented above minimize the potential for escalation. As an additional measure of protection, an Emergency Response Plan ("ERP"), that ensures that any emergencies are handled quickly and efficiently, was developed for the MFH Facility. The ERP is included in appendix 11C to this Resource Report.

11.2.2.3 Propane

The principal hazards of propane result from the flammability of vapors, potential loss of containment and vapor dispersion characteristics. Propane has a higher molecular weight than air, therefore vapors resulting from the vaporization of a propane spill are always heavier than air. A propane vapor cloud will always migrate towards the lowest point near the leak source (e.g., a release or spill). The distance that the vapor cloud will travel depends on many variables, including the volume of the initial release or spill, its duration, the wind velocity and direction, terrain, atmospheric temperature, and humidity. Although propane vapor has no color, its low temperature will cause condensation of water vapor in the air, forming a visible white cloud.

The MFH Facility only uses propane to feed the pilot light to the ground flare. Propane is stored in a 500-gallon propane storage vessel located near the ground flare, away from the major process area to reduce the potential for cascading events.

11.2.2.4 Nitrogen

Nitrogen presents a low temperature hazard in the event of a leak of cryogenic nitrogen. However, nitrogen has a boiling point of -320°F, so a liquid release would vaporize rapidly and mix with the surrounding air.

While nitrogen is non-toxic, it is classified as a simple asphyxiant and can cause asphyxiation when concentrations are sufficient to reduce oxygen levels below 18 percent. Low temperature detectors will be present around the nitrogen package to detect any leak and alert personnel.

Cascading events, including the failure of critical nitrogen equipment or structures, may introduce a hazard to the MFH Facility. However, the mitigation features presented above minimize the potential for the escalation of an event. As an additional measure of protection, an ERP, that ensures that any emergencies are handled quickly and efficiently, was developed for the MFH Facility.

11.2.2.5 Diesel

Diesel is used to fuel two emergency power generators. Each generator stores enough diesel in a tank to operate for 20 hours at design load; the tank is double-walled and located within the generator skid to minimize the likelihood of perforation. Any diesel leaks or spills will be contained within the curbed area that surrounds the generators. The diesel equipment is located away from the major process area to reduce the potential for cascading events. These measures ensure that there is no hazard posed to the public.

11.2.3 Marine Transportation Hazards

The USCG has jurisdiction under 33 CFR Part 127 for the "marine transfer area" of every waterfront LNG facility. The "marine transfer area" is defined as the part of the facility handling LNG between the vessel, or where the vessel moors, and the last manifold or valve immediately before the receiving tanks. USCG regulations provide detailed requirements for safety and security design features, operations and emergency planning, operator training, and maintenance.

The Energy Policy Act of 2005[1] also requires an ERP be prepared in consultation with USCG, as well as state and local agencies. The ERP "shall include a cost-sharing plan and a description of any direct cost reimbursements that the applicant agrees to provide to any state and local agencies with responsibility for security and safety at the LNG terminal and in proximity to vessels that serve the facility." Details on the cost-sharing plan for the MFH Facility are provided in Resource Report 13, section 13.39.1.14.

A facility security plan ("FSP") was prepared as required by 33 CFR Part 105 and submitted for review and approval to the COTP. The FSP is valid for five years.

Representatives of the Applicant submitted a Letter of Intent to the COTP on December 12, 2017, in accordance with 18 CFR section 157.21 and 33 CFR section 127.007. Upon review of the WSA and Follow-on WSA, the COTP issued a letter of recommendation ("LOR") to NFEnergía, pursuant to 33 CFR § 127.009, on September 26, 2018. The LOR conveyed the USCG's recommendation that "the waterways approaching and entering San Juan Harbor to Wharves A and B in Puerto Nuevo, Puerto Rico be considered suitable for LNG marine traffic". The LOR is included as appendix 11B to this Resource Report.

11.2.3.1 Results of the Ship Simulation Studies

The MFH Facility imports LNG via pocket sized LNG carriers, which moor against and transfer cargo to the FSU, which in turn transfers LNG to the shoreside facilities. The marine facilities are designed for LNG shuttle vessels up to 30,000 cubic meters ("m^3") in cargo carrying capacity, and a similarly sized FSU semi-permanently moored on-site.

LNG carriers will arrive from the north and enter the Bahía de San Juan ("San Juan Bay") via the Anegado channel, an existing deep draft channel which is approximately 40 feet (12.1m) deep and 800 feet (243.8 m) wide and allows for two-way traffic. The Anegado channel leads to a junction which allows access to the Army Terminal channel or the Graving Dock channel; both lead to the Puerto Nuevo channel, where the MFH Facility is located. Figure 11-1 shows the described channel and the MFH Facility location.

[1] Public Law 109-58—Aug. 8, 2005, Energy Policy Act of 2005

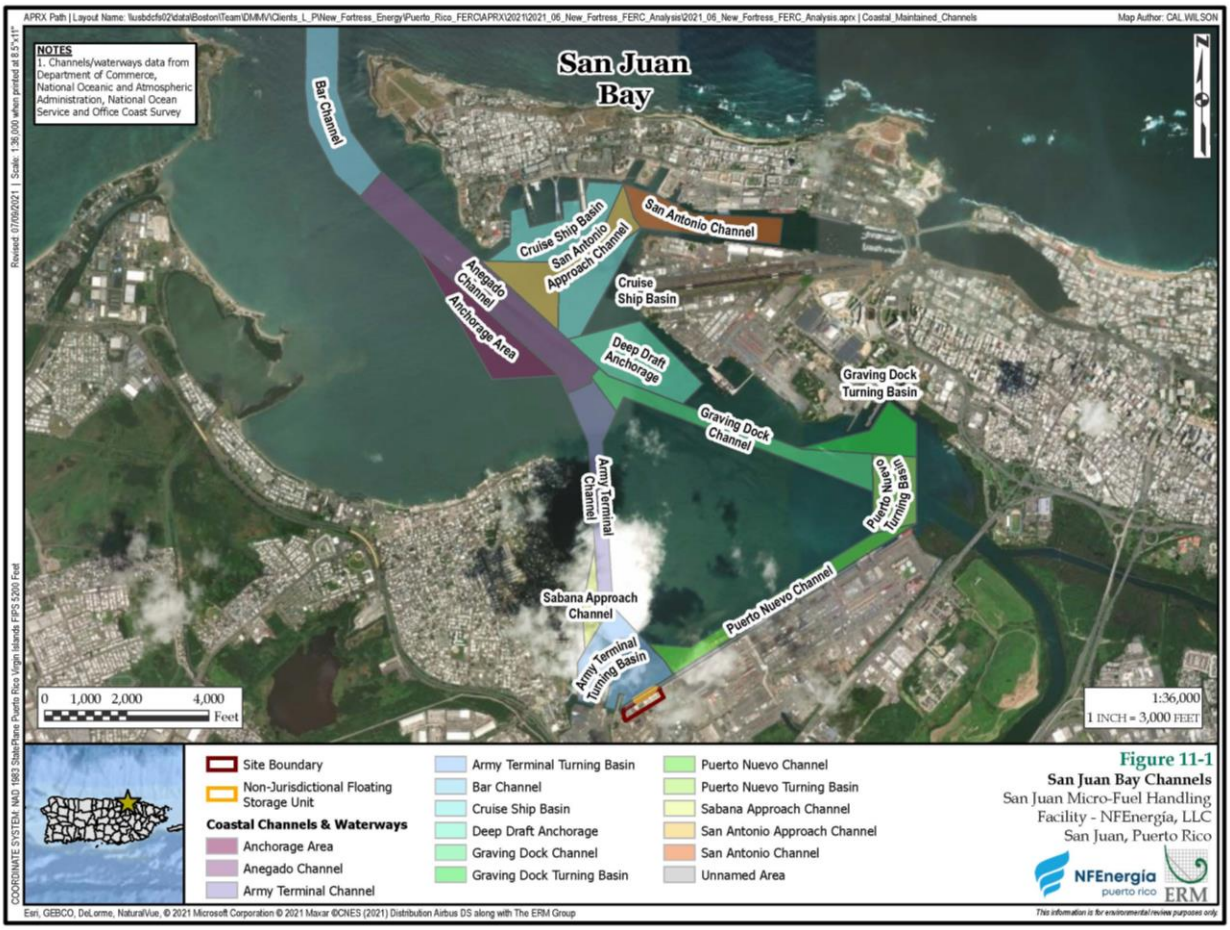

Figure 11-1: San Juan Bay Channels.

During the MFH Facility design, PIANC Report No. 121 "*Harbour Approach Channels Design Guidelines, 2014*", was used to determine the required width and depth required for the design LNG carriers to safely transit. The study concluded that the Army Terminal channel would have to be used for approach and departure of the LNG carriers transiting to and from the MFH Facility. The Army Terminal channel also meets the size requirements for the turning basin.

A set of Ship Maneuvering Simulations, including detailed berthing for the FSU and LNG carriers, was performed using full mission bridge maneuvering to assess the feasibility of the MFH Facility location in terms of initial approach and departure. The simulation runs are detailed in the *Navigation Assessment* report by Moffat & Nichol (Document No. 9212-19RP0004, Rev. A), which is included as appendix 11A to this Resource Report 11. All but one of the runs performed under allowable transit wind speeds (i.e., up to 25 knots) received a rating of "Good" or higher.

The results of the Ship Maneuvering Simulations concluded that:

- Navigation of the design 30,000 m^3 LNG carrier is feasible to and from the proposed marine facilities utilizing the existing navigation channels and Army Terminal turning basin, without any changes or modifications.

- Navigation is feasible for wind speeds up to 30 knots from the predominant directions; however, wind speeds of 20-25 knots are recommended as a preliminary upper limit for vessel maneuvers.

- Tugs from the existing fleet are capable of providing safe ship handling for all inbound and outbound maneuvers. The majority of the channel assessment maneuvers were performed with one conventional tug of 30 metric ton ("mt") bollard pull ("BP") combined with an Azimuthing Stern Drive tug of 53 mt BP. Although each of these maneuvers were performed successfully, it is recommended that two Azimuthing Stern Drive tugs of 53 mt BP should be used for the maneuver.

- The presence of an LNG carrier berthed at the MFH Facility does not adversely affect operations of the Catano Oil Dock or container ship traffic.

- The pilots from the San Juan Bay Pilots Corporation indicate these maneuvers are feasible and acceptable.

The Marine Berth, which is used to semi-permanently moor the FSU, includes four cone fenders, four quad quick-release hooks and two double quick-release hooks.

Unloading from the FSU to the MFH Facility occurs through two 8-inch diameter composite hoses for the transfer of LNG, and one 8-inch diameter composite hose for the transfer of LNG vapors.

11.2.3.2 Depictions of the Marine Hazard Zones

USCG Navigation and Vessel Inspection Circular ("NVIC") 01-11 Enclosure 9 discusses "Zones of Concern". As stated therein, "The 2004 Sandia Labs Report (SAND2004-6258) identified three concentric, circular 'Zones of Concern' for intentional spills from LNG tankers. That report, coupled with a Sandia study conducted in 2007 for larger volume LNG tankers (SAND2008-3153), indicated the hazard zone sizes described below can be used for LNG vessels with a cargo carrying capacity of up to 265,000 m^3. COTP may find the hazard zone size information and data particularly useful when reviewing an applicant's Follow-on WSA and in making a recommendation to FERC on the suitability of a waterway to support LNG marine traffic associated with a proposed project." Enclosure 9 further defines the zones as follows:

> Zone 1: This is the area with the most severe consequences around the LNG tanker, where an LNG spill could pose a severe public safety and property hazard and could damage or significantly disrupt critical infrastructure and key assets located within this area. Zone 1 is considered to extend about 500 m (0.3 miles) for an intentional breach of an LNG tanker. Risk management strategies should address vapor cloud dispersion and fire hazards. The most rigorous deterrent measures should be considered when major critical infrastructure elements, such as population or commercial centers, lie within Zone 1. These measures should include such things as vessel security zones, waterway traffic management, and establishment of positive control over vessels. Coordination among all port security stakeholders is essential. Incident management

> and emergency response measures should be carefully evaluated to ensure adequate resources (i.e., firefighting, salvage) are available for consequence and risk mitigation.
>
> Zone 2: This is an area with less severe consequences than Zone 1 and is considered to extend from 500 m (0.3 miles) to 1,600 m (1 mile) for an intentional breach of an LNG tanker. Risk management strategies should address vapor cloud dispersion and fire hazards. When major critical infrastructure elements occur within Zone 2, risk management strategies that should be considered include incident management and emergency response measures that ensure areas of refuge (enclosed areas, buildings) are available, the development of community warning procedures, and education programs to ensure that communities are aware of precautionary measures.
>
> Zone 3: This is an area with the least likelihood of severe consequences and is considered to extend from 1,600 m (1 mile) to a conservative maximum of 3,500 m (2.2 miles) from the LNG tanker, in the unlikely event that 3 cargo tanks were breached and a vapor cloud disperses without an initial ignition. Risk management strategies should address the vapor cloud dispersion hazard. When major critical infrastructure elements occur within Zone 3, risk management strategies that should be considered include incident management and emergency response measures that ensure areas of refuge are available and community education programs should be considered to ensure that people know what to do in the unlikely event of the release of a vapor cloud without initial ignition.

A graphic depiction of the Zones of Concern for the MFH Facility was included in the Follow-On WSA, which was submitted to the COTP on May 22, 2018. It should be noted that the Zones of Concern identified by Sandia were calculated based on LNG carrier capacities up to 265,000 m^3, whereas the MFH Facility uses pocket sized LNG vessels with capacities only up to 30,000 m^3; the Applicant included a graphic depiction of their articulated reduced Zones of Concern using actual vessel information in the Follow-On WSA.

11.2.3.3 Areas Impacted by the Marine Hazard Zones

Representatives of the Applicant submitted the Preliminary WSA dated December 12, 2017 to the COTP, and the Follow-On WSA on May 22, 2018, in accordance with 18 CFR section 157.21 and 33 CFR section 127.007.

The Follow-on WSA is a more detailed version of the Preliminary WSA and identifies credible security threats and safety hazards related to the transportation of LNG from the LNG carrier's entrance into United States territorial waters, LNG carrier transit to/from the MFH Facility, and operations at the vessel/facility interface. The results of the WSA provide the local COTP the information necessary to inform the permitting process that the MFH Facility and associated facilities are appropriate for the specific waterway. The results of the Follow-on WSA also provide the basis for developing safety and security plans for LNG carrier transits and MFH Facility operations within this waterway.

The WSA process is conducted in accordance with NVIC 01-2011 "Guidance Related to Waterfront Liquefied Natural Gas (LNG) Facilities" (NVIC 01-2011; USCG, 2011). This guidance sets forth a systematic and robust process for reviewing safety and security issues specific to the waterway and includes appropriate technical expertise and stakeholder involvement. NVIC 01-2011 calls for the involvement of a cross-section of public officials and industry responsible for the safe transit of LNG vessels inbound for or outbound from a United States port. The COTP may also involve existing ad-hoc committees, such as the Area Maritime Security Committee, which is made up of law enforcement and other port stakeholders, to participate in the process.

The WSA process considers potential infrastructure vulnerabilities and evaluates specific accidental and security threat scenarios, potential consequences of an LNG release, and existing safety systems and security countermeasures, as well as the need for additional risk management measures for the MFH Facility. A primary objective of the WSA process is to identify the federal, state, local, and private sector resources needed to carry out the mitigation measures developed during the assessment. The WSA identifies resources currently available and the mechanism by which funding will be provided for additional public resources needed for safe and secure LNG carrier transit.

Information on the density and character of marine traffic required in 33 CFR § 127.007 is outlined in the LOR Analysis; information is included on commercial, military, and recreational vessel uses and marine events and seasonal use.

11.2.3.4 Safeguards and Security Necessary to Mitigate Impacts

The LOR established a moving safety zone and a fixed safety zone to support LNG marine traffic:

- A moving safety zone of 100 yards will be implemented for all transiting LNG carriers; and
- A fixed 50-yard safety zone will be implemented around the vessel at all times while the vessel is moored at the Wharves A and B.

Additionally, the COTP specified several risk mitigation measures to be established and maintained by NFEnergía. Finally, the MFH Facility is a restricted area with access restricted to personnel authorized by NFEnergía.

11.2.4 Other Transportation Hazards

Based on the distance from the site to any external railroad system and the fact that the MFH Facility is not using rail transportation, no safety or reliability impacts are expected from rail activity at or near the proposed MFH Facility. Therefore, a Rail Safety and Reliability Study was not performed.

Given the limited height and lack of structures that extend outward or upward from a slope on the MFH Facility site, there was no requirement for NFEnergía to file a notice with the Federal Aviation Administration prior to construction of their MFH Facility structures. For the same reasons, NFEnergía does not anticipate any hazard to air travel from structures or ground flare operation during startup, shutdown, or upset conditions. Therefore, an Air Safety and Reliability Impact Study was not performed.

11.2.5 Crane and Lifting Hazards

The MFH Facility is built and operational. No lifting hazards are present during the MFH Facility's operation, and no further construction is planned for the MFH Facility.

11.2.6 Adjacent Hazards

Adjacent hazards were not explicitly considered in the design of the MFH Facility.

11.2.7 Natural Hazards

The MFH Facility includes minimal land-based process facilities, which allow it to ensure the safety of the general public and MFH Facility staff in the event of natural disaster, and to restore plant activities rapidly after the event, in order to ensure reliable energy supply for customers. The FSU-based design rendered LNG storage unnecessary, and therefore obviated any potential risks associated with large volumes of LNG stored on-site and sudden events such as seismic activity. Further, the FSU's maneuverability allows proactive response to mitigate damage from hurricanes or other strong storms

11.2.8 Security Threats and Vulnerability Assessments.

Security requirements are contained in the USCG regulations in 33 CFR Part 127 and 33 CFR Part 105, respectively. USCG is also responsible for the security of shipping in waters of the United States.

The MFH Facility is not subject to the requirements of Department of Homeland Security's Chemical Facility Anti-Terrorism Standards program.

11.3 HAZARD ANALYSES

11.3.1 Hazardous Releases

The MFH Facility was designed in accordance with the Puerto Rico Building Code, which adopts NFPA 59A-2006 via the 2009 International Building Code. The MFH Facility is not under DOT-PHMSA jurisdiction, therefore it is not subject to the design spill requirements in 49 CFR 193. The MFH Facility meets the applicability requirements of Chapter 13 in NFPA 59A-2006, therefore it is not subject to the design spill requirements in Chapter 5 of the same standard.

Chapter 13 of NFPA 59A-2006 does not require the evaluation of hazardous releases within the MFH Facility. In accordance with Chapter 13 of NFPA 59A-2006, the MFH Facility includes an impounding basin sized to collect the volume of the largest container. The distances between adjacent containers and between the edge of the impoundment basin and a property line that can be built upon exceed the minimum requirements specified in NFPA 59A-2006.

11.3.2 Hot and Cold Fluid Temperature Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of hot and cold fluid temperature hazards.

11.3.3 Asphyxiant and Toxic Vapor Dispersion Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of asphyxiant and toxic vapor dispersion hazards.

11.3.4 Flammable Vapor Dispersion Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of flammable vapor dispersion hazards.

11.3.5 Vapor Cloud Overpressure Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of vapor cloud overpressure hazards.

11.3.6 Fire Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of fire hazards.

11.3.7 Vessel Overpressure Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of vessel overpressure hazards.

11.3.8 Fog or Steam Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of fog or steam hazards.

11.3.9 Other Hazard Analysis

Chapter 13 of NFPA 59A-2006 does not require the evaluation of other hazards.

11.3.10 Hazardous Material Disposal

Chapter 13 of NFPA 59A-2006 does not require the evaluation of hazardous material disposal hazards.

11.4 Layers of Protection

The design of the MFH Facility includes multiple layers of protection to reduce the risk of a potentially hazardous scenario developing into an event, which could affect off-site persons and infrastructure. The layers of protection are considered independent of one another, i.e., each layer would perform its designed function regardless of the function of other layers.

11.4.1 Structural Design of the Facilities and Components

The structural design of the MFH Facility is in accordance with IBC 2009 and NFPA 59A 2016. In addition to the equipment dead weight loads, the foundations at MFH Facility are designed to meet the dynamic loads associated with wind pressure and ground motion due to seismic hazards that could occur at the MFH Facility.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13 appendix 13I—Natural Hazard Design Investigations and Forces; appendix 13J—Site Investigation and Conditions, and Foundation Design; appendix 13.—Specifications and appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.2 Mechanical Design of the Facilities and Components

The mechanical design of the MFH Facility complies with the requirements detailed in NFPA 59A-2016. The design of the MFH Facility includes the use of suitable materials for construction. The LNG suction drums are designed with appropriate materials; process piping is designed for cryogenic temperatures. Material selection for the process components is compatible with the operational and design limits (pressure, temperature etc.) of the systems. Piping is designed in accordance with ASME B31.3. The majority of LNG piping connections are welded to minimize the possibility of flange leaks. Pressure vessels are designed in accordance with ASME Section VIII.

In general, systems that include critical equipment required to support continuous operation of the MFH Facility were designed to include 2 x 100% equipment items for full redundancy.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13F—Specifications; appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.3 Operations and Maintenance Plans

The design of the MFH Facility includes Operations and Maintenance Plans as required by NFPA 59A-2016. Measures such as operating control system tools, procedures and training address the potential for human error and incorrect operation. Procedures for operation and maintenance of the MFH Facility comply with the following portions of NFPA 59A-2016:

- Chapter 14, Operating, Maintenance and Personnel Training:

Includes policies for operating procedures, monitoring of operations, emergency procedures, personnel safety, failure investigations, communication systems and operating records.

Includes policies for maintenance procedures, fire protection, isolating and purging, repairs, control systems, corrosion control and maintenance records.

Recruitment of the Operations and Maintenance Team commenced during the construction period, and all personnel involved in the day-to-day operation and maintenance of the MFH Facility received the required training, including mandatory continuous training.

- Appendix C, Security:

Includes policies for security procedures, protective enclosures, security communications, security monitoring, and warning signs.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13F—Specifications and appendix 13B—Design Basis, Criteria, and Philosophies. The Operating, Maintenance and Training Procedures for the MFH Facility are contained in Resource Report 13, appendix 13O4.

11.4.4 Basic Plant Control Systems

The design of the MFH Facility includes state-of-the-art control systems. These control systems include monitoring systems, process alarms and control and isolation valves that can be monitored in the control room. Alarms include visual and audible notification in the control room, as well as in the field, to warn operators that process conditions may be approaching design limits. Operators would have the capability to take action from the control room to mitigate an upset.

Alarm and shutdown setpoints, where available, are shown on the piping and instrumentation diagrams included in Resource Report 13, appendix 13E. Cause and effect matrices showing logic are provided in Resource Report 13, appendix 13Q. As-commissioned operating limits for flows, pressures, and temperatures are provided in Resource Report 13, appendix 13P.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13P—Process Control and Instrumentation; appendix 13E—Engineering Design Information; and appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.5 Safety Instrumented Systems

The design of the MFH Facility includes SIS that include safety control valves and emergency shutdown (“ESD”) systems designed to prevent a release if design limits are exceeded during operation. The exclusive purpose of this system is to bring the MFH Facility to a safe state. The system was designed in accordance with International Electrotechnical Commission 61511 Part 1, 2, and 3 Functional Safety—Safety Instrumented System (“SIS”) for the Process Industry Sector. Safety valves and instrumentation are installed to monitor, alarm, shut down, and isolate equipment and piping during process upsets or emergency conditions. The inherently fail-safe SIS will isolate plant areas, sectionalize and isolate inventories to limit materials in release event, and isolate potential ignition sources. The control room will initiate ESDs. The system power is provided with a backup uninterruptible power supply system to maintain control operation. Through the features detailed above, the SIS provides protection for equipment, personnel and the surrounding environment.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13P—Process Control & Instrumentation; appendix 13E—Engineering Design Information; and appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.6 Security Systems and Plans

The USCG has authority over the security plans for the entire MFH Facility. A facility security assessment was prepared, as required by 33 CFR Part 105, prior to MFH Facility startup. In addition, the FSP was prepared as required by 33 CFR Part 105 and submitted for review and approval to the COTP. The FSP is revalidated every five years. Additional security requirements for the MFH Facility are provided by NFPA 59A-2016. Section 12.9 of the standard includes requirements for conducting a security assessment and establishing protective enclosures, lighting, and security monitoring.

The design of the MFH Facility includes state-of-the-art systems to help maintain and operate the MFH Facility in a safe, secure, and reliable environment. Advances in monitoring systems, alarm systems, and communication systems have allowed LNG facilities to continue to have an impeccable security record. Security measures included in the design of the MFH Facility to control access include the following: perimeter security including inspections and patrols, controlled access points to access/egress the MFH Facility, restrictions and prohibitions applied at the access points with Transportation Worker Identification Card verification, intrusion detection, security and safety Closed Circuit Television monitoring with digital video feed and recording capabilities, Transportation Worker Identification Card identification systems, screening procedures, response procedures to security breaches, and liaison with local law enforcement officials. Emergency backup lighting will be provided in locations to allow personnel to reach a place of safety in the event of a main power outage.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13B—Design Basis, Criteria, and Philosophies and appendix 13E—Engineering Design Information.

11.4.7 Physical Protection Devices

The pressure relief and flare system (GCU) is designed to safely and reliably dispose of streams that are released during startup, shutdown and cool down. The design of the MFH Facility includes relief valves for process piping that physically protect the piping systems from operating beyond their design limits. Piping relief valves are connected to a GCU system by which any process upsets are sent to the ground flare for disposal. The safety relief valves are designed to handle process upsets and thermal expansion within piping, per NFPA 59A-2016 and ASME Section VIII. The flare system is designed such that the vent and drain systems are segregated from each other, the ground flare will operate with minimal smoke generation and a highly reliable ignition system, and thermal radiation will be in accordance with American Petroleum Institute RP 521.

The LNG suction drums include relief valves to protect the vessels from overpressure events. The drum relief valves discharge to the atmosphere.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13 appendix, 13C. Further details are included in Resource Report 13 appendix 13L—LNG Tank Information; appendix 13E—Engineering Design Information; and appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.8 Ignition Controls

The design of the MFH Facility includes ignition controls as specified in NFPA 59A-2016. The MFH Facility includes equipment that is electrically classified in accordance with NFPA 59A-2016, NFPA 70 and API RP 500 to mitigate potential ignition sources. The electrical design of the MFH Facility includes grounding of equipment. The MFH Facility procedures also include requirements for hot work permits to be obtained prior to work activities, smoking restrictions and other measures to minimize potential ignition sources at the MFH Facility. The MFH Facility has been designed such that areas likely to contain flammable gases are isolated from ignition sources in accordance with NFPA 70 and the National Electric Code. Electrical equipment used within these designated areas is housed in enclosures approved for this service and application.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13 appendix 13C. Further details are included in Resource Report 13 appendix 13N—Electrical Design Information and appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.9 Spill Containment System

The MFH Facility spill containment system is designed to convey spills away from process equipment into an impoundment basin located remotely. The design of the spill containment system meets the requirements of NFPA 59A-2006/2016, Chapter 13. The spill containment system is equipped with detection devices that will activate an automated alarm alerting the operator in the unlikely event of a spill.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13S—Spill, Toxic, Fire, and Explosion Protection and Calculations; appendix 13E—Engineering Design Information; appendix 13I—Natural Hazard Design Investigations and Forces; and appendix 13B—Design Basis, Criteria, and Philosophies.

11.4.9.1 LNG Storage Tank

The MFH Facility does not include an LNG storage tank. LNG is received from a shuttle vessel and loaded onto a semi-permanently moored FSU; from there, LNG is pumped to the vaporizers or to the truck loading station. The MFH Facility includes two suction drums, which are used to provide a buffer between the LNG supply from the FSU and the demand from the vaporizers or truck loading station. The suction drums are therefore process vessels and not storage tanks.

11.4.9.2 LNG Impoundment Sump

All LNG piping is contained within the boundaries of a spill containment system. In the unlikely event of an LNG leak or spill, LNG will flow on the sloped concrete floor and into the trough, which will then direct the liquid to the impoundment basin. The trough and spill impoundment are constructed of concrete and were designed and sized to minimize vapor formation during LNG spills. In accordance with the requirements of NFPA 59A-2006/2016, section 13.8.3, the holding capacity of the impoundment basin was sized to exceed the volume of the largest container, which is the vaporization suction drum with a capacity of 33,000 US gal.

Based on instrumentation installed to detect the occurrence of LNG leaks, an active automated alarm would alert the operator to shut down the LNG transfer. This well-proven design is effective in reducing the potential hazards that would result from the dispersion of an unignited vapor cloud as well as from thermal radiation caused by an LNG pool fire. The impoundment basin also includes a layer of Foamglas Gen-2 blocks; the system provides passive protection and mitigation of flammable vapor dispersion and thermal radiation hazards in the event of an LNG spill.

In accordance with the requirements of NFPA 59A-2006/2016 section 13.8, the LNG spill containment basin includes a sump to collect rainwater from the containment area. Automatically controlled sump pumps are installed in the sump to remove water from the LNG spill containment basin. The water removal system has the capacity to remove water at a minimum rate of 25 percent of the rate from a storm of a 10-year frequency and 1-hour duration. The sump pump is fitted with an automatic shutoff device that prevents its operation when exposed to LNG temperatures.

The location of the impoundment sump is illustrated on the plot plan included in Resource Report 13, appendix 13A. The flow of spills into the impoundment sump is illustrated on the Grading Drawings included in Resource Report 13, appendix 13S. The spill containment sizing is discussed in the Facility Siting Report, which is provided in Resource Report 13, appendix 13H3.

11.4.10 Passive Protection for Cryogenic Fluids, Overpressures, Projectiles, and Fires

The design of the MFH Facility includes passive protection measures that go beyond equipment layout, such as proper process design to minimize hydrocarbon inventory, isolation of inventory segments, and moving flammable inventory out of the area of hazard to the flare in the shortest practical time, where applicable. Spacing of vessels and equipment, separation from ignition sources, and setbacks from property lines were determined in accordance with NFPA 59A-2006. All process areas were designed to be as open as possible to minimize the potential for enclosed spaces leading to overpressures.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C.

11.4.11 Hazard Detection and Mitigation System

The MFH Facility is designed to minimize the occurrence of events that could result in the release of LNG and to mitigate the potential impacts of such releases to the public and plant personnel. The integrated control and safety system consists of field instrumentation, field mounted remote I/O panels distributed throughout the MFH Facility, control processors located in the main control building, and communication interfaces with the control systems of other specific process licensor units and packaged equipment units. The control system types consist of a Basic Process Control System (the Distributed Control System), SIS and Fire & Gas (“F&G”) system.

The SIS is an independent high integrity system, separate from the Distributed Control System. It is comprised of dedicated input devices (e.g., sensors, selector switches and push

buttons installed in the field and control room), logic solvers, and output devices (final elements). The SIS is based on a redundant programmable system with fail-safe design, having high reliability, high availability and fault-tolerant equipment complete with redundant communication and redundant processor architecture.

The F&G system is an independent, stand-alone, high integrity system that continuously monitors the MFH Facility and alerts operating personnel to spills, fires or flammable gas leaks. The F&G system is designed to meet the performance standards described in NFPA 72. The MFH Facility system is fault-tolerant and self-supervising to alert operating personnel of faulty conditions.

Elements of the F&G systems include:

- Flammable gas detectors;
- Low temperature detectors;
- Flame detectors;
- Smoke and heat detectors (indoors applications); and
- Automatic self-contained extinguishing systems (clean agents).

The control system provides the means to monitor for and alert operators of hazardous conditions throughout the MFH Facility resulting from fires and LNG spills. The detection of these hazardous conditions by the F&G system will result in local audio and visual (e.g., strobe lights) signals with various alarms and colors depending on the detected hazard. The control system will then have the capability to initiate automatic shutdown of specific systems and may activate the wider ESD system response. Firewater and fire suppression/extinguishing systems are provided to protect personnel, the public, the FSU and MFH Facility equipment in the event of a fire.

A Fire Protection Evaluation was performed to ensure that the design of the Hazard Detection and Mitigation System is sufficient and meets the requirements of NFPA 59A-2006, section 12.2. The evaluation is included in Resource Report 13, appendix 13S.

A listing of the Codes and Standards to which the MFH Facility would be designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13E—Engineering Design Information.

11.4.12 Hazard Control Equipment

The MFH Facility is designed with hazard control equipment which will operate to minimize the impact of a hazardous event. Elements of this system include:

- firewater system;
- foamglas blocks;

- clean agent system; and
- carbon dioxide and ABC dry chemical fire extinguishers.

Portable, fixed, and wheeled dry chemical extinguishers are strategically located around the MFH Facility and provide a means to extinguish hydrocarbon fires. The MFH Facility design incorporates a firewater system that includes monitors, hydrants, and hoses, which can provide firewater to cool adjacent equipment and minimize impacts from an incident. Carbon dioxide extinguishers are provided in the electrical building. ABC fire extinguishers are provided in the guard house and operations buildings, as well as in the MFH Facility parking lot. The layout and design of the hazard control equipment meets the requirements of NFPA 59A-2006.

A Fire Protection Evaluation was performed to ensure that the design of the Hazard Detection and Mitigation System is sufficient and meets the requirements of NFPA 59A-2006, section 12.1.2. This evaluation is included in Resource Report 13, appendix 13S.

A listing of the Codes and Standards to which the MFH Facility was designed is included in Resource Report 13, appendix 13D. A Regulatory Compliance Matrix is available in Resource Report 13, appendix 13C. Further details are included in Resource Report 13, appendix 13B—Design Basis, Criteria, and Philosophies; appendix 13S—Spill, Toxic, Fire, and Explosion Protection; and appendix 13E—Engineering Design Information.

11.4.13 Emergency Response

The ERP establishes the procedures for responding to specific emergencies that may occur at the MFH Facility, as well as procedures for emergency situations that could affect the public along the LNG carrier transit routes. The ERP was developed in consultation with local, state, and federal agencies, as well as with other stakeholders.

ERP coordination took place with local port authorities, fire, police, and public officials. Comments and suggestions of these local agencies were incorporated into the ERP as appropriate. Throughout the MFH Facility's operation, liaison and awareness programs will be maintained with these agencies to exchange information about the resources and responsibilities of each organization that may respond to accidents or natural catastrophes, and to coordinate mutual assistance.

The ERP will include a cost-sharing plan describing NFEnergía's contributions, including equipment donations, to state and local agencies with the responsibility for security and safety of the MFH Facility. Resource Report 13, Section 13.39.1.14 provides more information about NFEnergía's cost-sharing and coordination activities.

Guidelines for response training requirements of appropriate personnel are included in the ERP. The ERP is provided in appendix 11C herein.

11.5 Reliability

The design of the MFH Facility includes numerous measures to ensure its overall reliability throughout its design life. The MFH Facility incorporates only proven design and technologies and is built to the Codes and Standards listed in the Codes and Standards document in Resource Report 13, appendix 13D.

The MFH Facility design is further aimed at giving "state-of-the-art" levels of operability, reliability, availability, and maintainability. Only cryogenic equipment from vendors who have a proven record of operation in LNG service is used in the MFH Facility. The equipment includes but is not limited to vaporizers, pressure vessels, pumps, heat exchangers, valves, piping, and instrumentation. The use of different manufacturers or types of vendor-supplied equipment for similar applications was minimized in order to improve the operability and maintainability of the MFH Facility and to consolidate and therefore minimize the inventory of required spare parts.

The MFH Facility is designed to permit unconstrained operation over the range of ambient conditions referred to in the Design Basis included in Resource Report 13, appendix 13B. It is provided with suitable weather protection to enable operation and maintenance procedures to be undertaken under all design weather conditions.

11.5.1 Equipment Redundancies

The MFH Facility is designed for continuous operation except in the case of a total power outage. Necessary equipment redundancies are included, such that normal maintenance and inspection can be accomplished while sustaining the design regasification and truck loading rates.

11.5.2 Sparing Philosophy

The sparing philosophy for specific equipment and is described in the Basic Engineering Design Data, included in Resource Report 13, appendix 13B1—Basis of Design.

11.5.3 Warehouse Philosophy

Critical equipment and components are stored in the warehouse. The warehouse philosophy is to ensure that the plant will have necessary equipment and components stored to meet equipment criticality and minimum availability requirements.

11.5.4 Anticipated Plant Reliability and Availability

The LNG vaporization system installed at the MFH Facility was designed with double redundancy for high reliability and availability of the PREPA power plant. In general, systems with critical equipment required to support continuous operation of the MFH Facility were designed to include redundant equipment items.

11.5.5 Design Life

The design life of the MFH Facility is a 30-year service life. After the initial design life, further life expectancy can be accomplished through a system of operations and maintenance inspections. The MFH Facility will follow all operational and maintenance requirements detailed in NFPA 59A-2016 to ensure a minimum design life of 30-plus years.

11.6 Regulatory Oversight for Pipeline

The MFH Facility receives LNG from LNG shuttle vessels and delivers it to customers via LNG trucks, or regasifies it and supplies the natural gas to the adjacent power plant via a short, 10-inch diameter segment of power plant piping. Therefore, the MFH Facility is not connected to a pipeline. This short segment of power plant piping was constructed pursuant to an authorization

from the Puerto Rico Department of Transportation and Public Words and in compliance with the conditions of that authorization.

11.7 Pipeline Hazard Identification

Not applicable.

11.8 Class Locations and High Consequence Areas

Not applicable.

11.9 Pipeline Layers of Protection

Not applicable.

APPENDIX 11A LNG SHIP MANEUVERING SIMULATION REPORT

**Contains Critical Energy Infrastructure Information –
FILED UNDER SEPARATE COVER**

APPENDIX 11B USCG LOR

U.S. Department of Homeland Security
United States Coast Guard

Commander
United States Coast Guard
Sector San Juan

5 Calle La Puntilla
San Juan, PR 00901-1819
Phone: (787) 729-2300

BGM 9/26/18

16610
P 405-18
September 26, 2018

NFEnergia, LLC
Attn: Capt. Mark Lane
111 W. 19th Street, 8th Floor
New York, NY 10011

Dear Captain Lane:

This Letter of Recommendation (LOR) is issued pursuant to 33 C.F.R. § 127.009 and in response to the Letter of Intent submitted by your company on December 12, 2017, proposing to transport Liquefied Natural Gas (LNG) by ship to Wharves A and B in Puerto Nuevo, Puerto Rico. This LOR conveys the Coast Guard's recommendation that the waterways approaching and entering San Juan Harbor to Wharves A and B in Puerto Nuevo, Puerto Rico be considered suitable for LNG marine traffic. In addition to meeting the requirements of 33 C.F.R. § 127.009, this letter also fulfills the Coast Guard's commitment to provide information to your agency.

My recommendation on the suitability of these waterways is provided to assist your company in the proposal, planning, and execution of the concept of operations for your facility. Because certain sections of the LOR Analysis contain security related data that is "Security Sensitive Information" (SSI), two versions are enclosed. The first contains SSI. The second has all SSI redacted and is marked as such, indicating that it is releasable to the general public. This letter and redacted version of the accompanying analysis may be provided to other agencies as needed.

My staff will continue to monitor the progress of this project and will maintain communications with the project managers from your company and its partners. We are committed to ensure that all safety and security measures necessary to safeguard the public health and welfare, critical marine infrastructure and the marine environment are fully implemented and maintained.

If you have questions regarding this letter of recommendation, my point of contact is Lieutenant Commander Jose Rosario, who can be reached at (787) 289-2378 or Jose.M.Rosario@uscg.mil.

Sincerely,

E.P. King
Captain, U. S. Coast Guard
Captain of the Port

Enclosures: (1) Letter of Recommendation Analysis (Redacted)
(2) Letter of Recommendation Analysis (SSI)

Copy: Commander Coast Guard District 7 (dp)
Commander Atlantic Area (ap)

U.S. Department of Homeland Security
United States Coast Guard

Captain of the Port
United States Coast Guard
Sector San Juan

5 Calle La Puntilla
San Juan, PR 00901-1819
Phone: (787) 729-2376
Fax: (787) 729-2377
e-mail: ssjcc@uscg.mil

16600
P 419-18
26 Sep 18

MEMORANDUM

From: E. P. King, CAPT
CG SECTOR San Juan (s)

Reply to Attn of: LCDR Jose M. Rosario
(787) 729-2374

To: Federal Energy Regulatory Commission (FERC)

Thru: CG D7(dpw)
CG-FAC-2

Subj: RECOMMENDATION OF WATERWAY SUITABILITY OF SAN JUAN HARBOR FOR NFENERGIA, LLC PROPOSED OPERATIONS

Ref: (a) My memo 16600 dtd 23 Aug 18

1. Previously, in reference (a), I provided notice to FERC of the planned operations of NFEnergia, LLC in San Juan Harbor. As part of this notice, I indicated my staff was analyzing the suitability of the waterway associated with these operations as required by 33 C.F.R. § 127.009. That analysis is now complete, and this Letter of Recommendation (LOR) conveys the Coast Guard's recommendation the waterways approaching and entering San Juan Harbor to Wharves A and B in Puerto Nuevo, Puerto Rico be considered suitable for LNG marine traffic. My recommendation is based on the review of the NFEnergia, LLC's submitted Waterways Suitability Assessment, the follow-on Waterways Suitability Assessment, and the application of the factors listed factors listed in 33 C.F.R. § 127.007 and 33 C.F.R. § 127.009. The reasons supporting my recommendation are more thoroughly in the enclosed LOR Analysis (LOR-A). In addition to meeting the requirements of 33 C.F.R. § 127.009, this letter also fulfills the Coast Guard's commitment for providing information to your agency under the Interagency Agreement signed in February 2004.

2. On September 4, 2018, I completed a review of the WSA and the follow-on WSA for the proposed facilities, both temporary and permanent, submitted by NFEnergia, LLC. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 01-2011. The review focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterways. My analysis included an assessment of the risks posed by these transits and possible management measures that could be imposed to mitigate these risks. During the review, I consulted with members from the Harbor Safety Committees, Area Maritime Security Committee, Puerto Rico government and industry partners. Notably, a two-day long workshop with port stakeholders was held by NFEnergia, LLC and attended by my staff. During this process, I collected their input and recommendations relating to future operations and potential impacts to the waterways in San Juan Harbor. Following the formal consultation and validation of the WSA, my staff developed the enclosed LOR-A, which contains a detailed summary of the WSA review process that guided this recommendation. Because certain

sections of the LOR-A contain security-related data that is "Sensitive Security Inforamtion" (SSI), two versions are enclosed. The first contains SSI. The second has all SSI redacted and is marked as such, to indicate that it is releasable to the general public.

3. My recommendation of the suitability of these waterways is provided to assist you in your determination of whether the proposed facility should be commissioned. The information in the enclosed LOR-A may be used by you if you deem conditions are warranted in your Commission Order – if required. As with all issues related to waterway safety and security, I will assess each transit on a case by case basis to identify what, if any, safety and security measures are necessary to safeguard the public health and welfare, critical marine infrastructure and key resources, the port, the marine environment, and the vessel.

4. Should you have any questions or need additional information, please do not hesitate to contact my staff. My point of contact for this matter is LCDR Jose M. Rosario, who can be reached at Jose. M. Rosario@uscg.mil or 787-729-2374.

#

Enclosures: (1) Letter of Recommendation Analysis (SSI)
(2) Letter of Recommendation Analysis (Redacted)

Copy: Commander, Coast Guard District Seven (dp)
Commander, Atlantic Area (ap)
NFEnergia, LLC

U.S. Department of Homeland Security
United States Coast Guard

Commander
U.S. Coast Guard
Sector San Juan

5 Calle La Puntilla
San Juan, PR 00901-1819
Phone: (787) 729-2300

16610
P 404-18
September 26, 2018

Public Service Commission
Attn: President Luis D. Garcia-Fraga
PO Box 190870
San Juan, Puerto Rico 00919

Dear President Garcia-Fraga:

This Letter of Recommendation (LOR) is issued pursuant to 33 C.F.R. § 127.009 in response to the Letter of Intent submitted by NFEnergia, LLC on December 12, 2017 proposing to transport Liquefied Natural Gas (LNG) by ship to the Wharves A and B in Puerto Nuevo, San Juan, Puerto Rico. After reviewing the information in the applicant's Letter of Intent (LOI), the Waterway Suitability Assessment (WSA) materials submitted by your company, and applying the factors listed in 33 C.F.R. § 127.007 and 33 C.F.R. § 127.009, this LOR conveys the Coast Guard's recommendation that the waterways approaching and entering San Juan Harbor to Wharves A and B in Puerto Nuevo, Puerto Rico be considered suitable for LNG marine traffic. In addition to meeting the requirements of 33 C.F.R. § 127.009, this letter also fulfills the Coast Guard's commitment to provide information to your agency.

On September 4th, 2018, I completed a review of the WSA and the follow-on WSA for the proposed facilities, both temporary and permanent, submitted by NFEnergia, LLC. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 01-2011. The review focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterways. My analysis included an assessment of the risks posed by these transits and possible management measures that could be imposed to mitigate these risks. During the review, I consulted with members from the Harbor Safety Committees, Area Maritime Security Committee, Puerto Rico government and industry partners. Notably, a two-day long workshop with port stakeholders was held by NFEnergia, LLC and attended by my staff. During this process, I collected their input and recommendations relating to future operations and potential impacts to the waterways in San Juan Harbor. Following the formal consultation and validation of the WSA, my staff developed the attached LOR Analysis, which contains a detailed summary of the WSA review process that guided this favorable recommendation.

My recommendation of the suitability of these waterways is provided to assist you in your determination of whether the proposed facility should be commissioned. The information in the attached LOR Analysis may be used by you if you deem conditions are warranted in your Commission Order.

As with all issues related to waterway safety and security, my staff will continue to monitor the progress of this project and will maintain communications with the project managers from NFEnergia, LLC and its partners. We are sincerely committed to ensure that all safety and security measures necessary to safeguard the public health and welfare, critical marine infrastructure and the marine environment are fully implemented and maintained.

16610
P 404-18
September 26, 2018

If you have questions regarding this recommendation, my point of contact is LCDR Jose Rosario. He can be reached by telephone at (787) 289-2378 or by e-mail at Jose.M.Rosario@uscg.mil.

Sincerely,

E.P. King
Captain, U. S. Coast Guard
Captain of the Port

Enclosures: Letter of Recommendation Analysis (Redacted)

Copy: Commander Coast Guard District 7 (dp)
Commander Atlantic Area (ap)
NFEnergia, LLC

APPENDIX 11C EMERGENCY RESPONSE PLAN

Contains Critical Energy Infrastructure Information –

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