PUBLIC

NFEnergía LLC

San Juan Micro-Fuel Handling Facility

Resource Report 13
Engineering and Design Material

Docket No.
CP21-___-000

September 15, 2021

NFEnergía LLC
SAN JUAN MICRO-FUEL HANDLING FACILITY
RESOURCE REPORT 13—ENGINEERING AND DESIGN MATERIAL

Minimum Filing Requirements for Environmental Reports:	**Addressed in Section:**
Provide all the listed detailed engineering materials (§ 380.12(o)) These include:	
1. Provide a detailed plot plan showing the location of all major components to be installed, including compression, pretreatment, liquefaction, storage, transfer piping, vaporization, truck loading/unloading, vent stacks, pumps, and auxiliary or appurtenant service facilities.	Appendix 13.A.1
2. Provide a detailed layout of the fire protection system showing the location of firewater pumps, piping, hydrants, hose reels, dry chemical systems, high expansion foam systems, and auxiliary or appurtenant service facilities.	Section 13.S.10
3. Provide a layout of the hazard detection system showing the location of combustible-gas detectors, fire detectors, heat detectors, smoke or combustion product detectors, and low temperature detectors. Identify those detectors that activate automatic shutdowns and the equipment that will shut down. Include all safety provisions incorporated in the plant design, including automatic and manually activated emergency shutdown systems.	Appendix 13.S.6
4. Provide a detailed layout of the spill containment system showing the location of impoundments, sumps, subdikes, channels, and water removal systems.	Appendix 13.S.3
5. Provide manufacturer's specifications, drawings, and literature on the fail-safe shutoff valve for each loading area at a marine terminal (if applicable).	Appendix 13.Q.5
6. Provide a detailed layout of the fuel gas system showing all taps with process components.	Appendix 13.E.5
7. Provide copies of company, engineering firm, or consultant studies of a conceptual nature that show the engineering planning or design approach to the construction of new facilities or plants.	Not Applicable – operating facility
8. Provide engineering information on major process components related to the first six items above, which include (as applicable) function, capacity, type, manufacturer, drive system (horsepower, voltage), operating pressure, and temperature.	Appendix 13.M
9. Provide manuals and construction drawings for liquefied natural gas ("LNG") storage tank(s).	Not Applicable
10. Provide up-to-date piping and instrumentation diagrams. Include a description of the instrumentation and control philosophy, type of instrumentation (pneumatic, electronic), use of computer technology, and control room display and operation. Also, provide an overall schematic diagram of the entire process flow system, including maps, materials, and energy balances.	Appendix 13.E.5
11. Provide engineering information on the plant's electrical power generation system, distribution system, emergency power system, uninterruptible power system, and battery backup system.	Appendix 13.N
12. Identify all codes and standards under which the plant (and marine terminal, if applicable) will be designed, and any special considerations or safety provisions that were applied to the design of plant components.	Appendix 13.D
13. Provide a list of all permits or approvals from local, state, Federal, or Native American groups or Indian agencies required prior to and during construction of the plant, and the status of each, including the date filed, the date issued, and any known obstacles to approval. Include a description of data records required for submission to such agencies and transcripts of any public hearings by such agencies. Also provide copies of any correspondence relating to the actions by all, or any, of these agencies regarding all required approvals.	See Resource Report 1
14. Identify how each applicable requirement will comply with 49 C.F.R. part 193 and the National Fire Protection Association 59A LNG Standards. For new facilities, the siting requirements of 49 C.F.R. part 193, subpart B, must be given special attention. If applicable, vapor dispersion calculations from LNG spills over water should also be presented to ensure compliance with the United States Coast Guard's LNG regulations in 33 C.F.R. part 127.	Appendix 13.C (for National Fire Protection Association 59A compliance)
15. Provide seismic information specified in Data Requirements for the Seismic Review of LNG facilities (NBSIR 84-2833, available from Federal Energy Regulatory Commission staff) for facilities that will be located in zone 2, 3, or 4 of the Uniform Building Code Seismic Map of the United States.	Appendix 13.I, Appendix 13.J

NFEnergía LLC
SAN JUAN MICRO-FUEL HANDLING FACILITY
RESOURCE REPORT 13—ENGINEERING AND DESIGN MATERIAL

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ACRONYMS AND ABBREVIATIONS

ASCE	American Society of Civil Engineers
BOG	boil-off gas
BPCS	Basic Process Control System Design
CCTV	closed-circuit television
CFR	Code of Federal Regulations
CMMS	computerized maintenance management system
DCS	Distributed Control System
DE	Design Earthquake
ERC	Emergency Release Coupling
ERP	Emergency Response Plan
ESD	emergency shutdown
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FGS	Fire and Gas Detection System
FIS	Flood Insurance Study
FSU	Floating Storage Unit
GCU	gas combustion unit
gpm	gallons per minute
HHV	higher heating value
HMI	Human Machine Interface
HP	high pressure
HZ	hertz
ICSS	Integrated Control and Safety System
kV	kilovolt
kVA	kilovolt-ampere
LED	light-emitting diode
lb/hr	pound per hour
LFL	lower flammable limit
LHV	lower heating value
LNG	liquefied natural gas
m	meter
m^3	cubic meters
MCE	maximum considered earthquake
MCT	maximum considered tsunami
MFH Facility	San Juan Micro-Fuel Handling Facility
MLLW	Mean Lower Low Water
MMscfd	million standard cubic feet per day
NDBC	National Data Buoy Center
NFEnergía	NFEnergía LLC
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
OBE	Operating Basis Earthquake
P&ID	piping and instrumentation design
PAGA	Public Address and General Alarm
PCS	Process Control System
PLC	programmable logic controller
PREPA	Puerto Rico Electric Power Authority

psig	pound per square inch gauge
QRH	quick-release hook
scfm	standard cubic feet per minute
SIL	safety integrity level
SIS	Safety Instrumented System
SJPP	San Juan Power Plant
SSE	Safe Shutdown Earthquake
STS	ship-to-ship
UPS	Uninterruptable Power Supply

NFEnergía LLC
SAN JUAN MICRO-FUEL HANDLING FACILITY
RESOURCE REPORT 13—ENGINEERING AND DESIGN MATERIAL

13.0 RESOURCE REPORT 13—ENGINEERING AND DESIGN MATERIAL

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 NFEnergia 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 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 1 (18 Code of Federal Regulations ["CFR"] § 380.12) is included before the table of contents.

13.1 GENERAL BACKGROUND AND PROJECT MANAGEMENT

13.1.1 Project Facilities

13.1.1.1 Number of marine docks, and with both rated and maximum export and import rates, MMscfd and million tons per annum

The MFH Facility includes one marine berth at Puerto Nuevo with a semi-permanently moored FSU. The MFH Facility supplies LNG for loading onto trucks for delivery throughout Puerto Rico and regasified LNG to the adjacent SJPP for use as fuel. The maximum sendout capacity of the MFH Facility is approximately 130 MMscfd for regas and 87.5 MMscfd for truck loading (equivalent to 1.06 million gal/day).

13.1.1.2 Number of LNG storage tanks, and with both net and gross storage capacity per tank, gal and cubic meter ("m3") and equivalent billion standard cubic feet of natural gas

The MFH Facility does not include LNG storage tanks.

13.1.1.3 Number of liquefaction trains, and with both rated and anticipated maximum liquefaction capacity per train, MMscfd and MTPA

There are no liquefaction trains at the MFH Facility.

13.1.1.4 Number of LNG vaporizers, and with both sustained and anticipated maximum vaporization capacities, MMscfd

There are two gas-fired, water bath vaporization packages at the MFH Facility, each with a design capacity of 65MMscfd. A future tie-in connection exists for a shell-and-tube heat exchanger on each package, but NFEnergía has no current plans for their installation.

Further information on the vaporization packages is provided in the equipment list, which is included as appendix 13M3.

13.1.1.5 Number of feed gas pipelines and interconnects, and with both rated and anticipated maximum capacities, MMscfd, and pressures, pounds per square inch gauge

There are no feed gas pipelines or interconnects at the MFH Facility.

13.1.1.6 Number of sendout pipelines and interconnects, and with both rated and anticipated maximum sendout rates, MMscfd

Natural gas leaves the MFH Facility via a short, 10-inch diameter segment of power plant piping that interconnects with the adjacent SJPP. The design maximum vaporized LNG flowrate from the MFH Facility is 130 MMscfd based on the installed vaporizers. The natural gas is metered using an ultrasonic-type flow meter for custody transfer, which is currently limited to a maximum capacity of 90 MMscfd until a second meter run is added to the sendout metering skid. The maximum sendout rate that can be received at SJPP is 80 MMscfd.

13.1.1.7 Fractionation products, and with both rated and anticipated maximum capacity rates, gallons per minute ("gpm") and MMscfd

There are no fractionation products at the MFH Facility.

13.1.2 Location

13.1.2.1 Owned and leased property boundaries, options, easements, and rights of way with reference to Site Location Maps and Drawings in appendix 13A1

The MFH Facility is located in the Puerto Nuevo section of the Port of San Juan (Puerto de San Juan), a seaport facility located in San Juan, Puerto Rico. The MFH Facility site is located at Wharf A and Wharf B and is shown on a portion of the National Oceanic and Atmospheric Administration ("NOAA") chart in figure 13-1.

The nautical chart coordinates of the MFH Facility are:

- Latitude: 18°25'43.7" N
- Longitude: 066°06'21.2" west

The Lambert coordinates for the MFH Facility are:

- X = 234,610; Y = 265,892 (NAD 1983)

Figure 13-1: Micro-Fuel Handling Facility location.

13.1.3 Owner, Principal Contractors, and Operator

13.1.3.1 Owner of the facilities with reference to the Organizational Structure in appendix 13A2

The MFH Facility is owned by NFEnergía, a wholly-owned subsidiary of New Fortress Energy Inc. The organization chart is included in appendix 13A2.

*13.1.3.2 Principal Contractors identified for design, engineering, procurement, and construction of the facilities with reference to any preliminary Construction Workforce Organizational Chart or Work Breakdown Structure (if available) in appendix 13A3**

Black & Veatch was selected as the process engineering design contractor. Moffatt & Nichol was responsible for the marine facilities, civil, structural, architectural and electrical design and engineering of the MFH Facility. Neptune Fire Protection was the contractor for the fire protection design. Fuentes, Arcadian, and Lord Electric were the main contractors for the construction of the MFH Facility. NFEnergía oversaw the construction of the MFH Facility.

*13.1.3.3 Operating Company of the facilities with reference to a preliminary Operating Workforce Organizational Chart in appendix 13A4**

The MFH Facility is operated by NFEnergía. The Operating Workforce Organizational Chart is included in appendix 13A4.

13.1.4 Feed and Sendout Product(s)

13.1.4.1 Natural gas pipeline(s) sending out to

The MFH Facility supplies natural gas to Units 5 and 6 of the Puerto Rico Electric Power Authority ("PREPA") SJPP, which is adjacent to the MFH Facility and shares its southeast boundary. The pipe supplying SJPP measures 10 inches in diameter and is approximately 75 feet long; the pipe runs below grade from the MFH Facility's metering station to the Units 5 and 6 boundary.

13.1.4.2 Natural gas pipelines feeding from

There are no natural gas pipelines supplying feed gas to the MFH Facility.

13.1.4.3 Fractionation product pipelines sending out to

There are no fractionation pipelines in the MFH Facility.

13.1.5 Project Schedule

Demolition works of the preexisting facilities at the MFH Facility site began in September 2018, with civil works and other construction beginning in April 2019. The MFH Facility was commissioned in May 2020.

13.2 SITE INFORMATION

13.2.1 Site Conditions

The MFH Facility area is flat and located at an elevation of 7 feet above mean sea level. Additional site information including the Site Topographic Map can be found in appendix 13J1.

13.2.1.1 Elevation reference, North American Vertical Datum of 1988 (NAVD88) or National Geodetic Vertical Datum of 1929 (NGVD29)

The elevation reference is North American Vertical Datum of 1988 (NAVD88).

13.2.1.2 Marine platform elevation, feet

The marine platform elevation is +35 feet (Mean Lower Low Water [“MLLW”]).

13.2.1.3 LNG storage tank inner tank bottom elevation, feet

There are no LNG storage tanks installed at the MFH Facility.

13.2.1.4 Process areas foundation elevation, feet

The gas-fired vaporizers foundation elevations are +8.3 feet. Top of the suction drum foundations are at +9.6 feet.

13.2.1.5 Impoundment floor elevation, feet

The impoundment sump floor elevation is -6.59 feet.

13.2.1.6 Utilities foundation elevation, feet

The utilities foundation elevation is +7.80 feet.

13.2.1.7 Buildings foundation elevation, feet

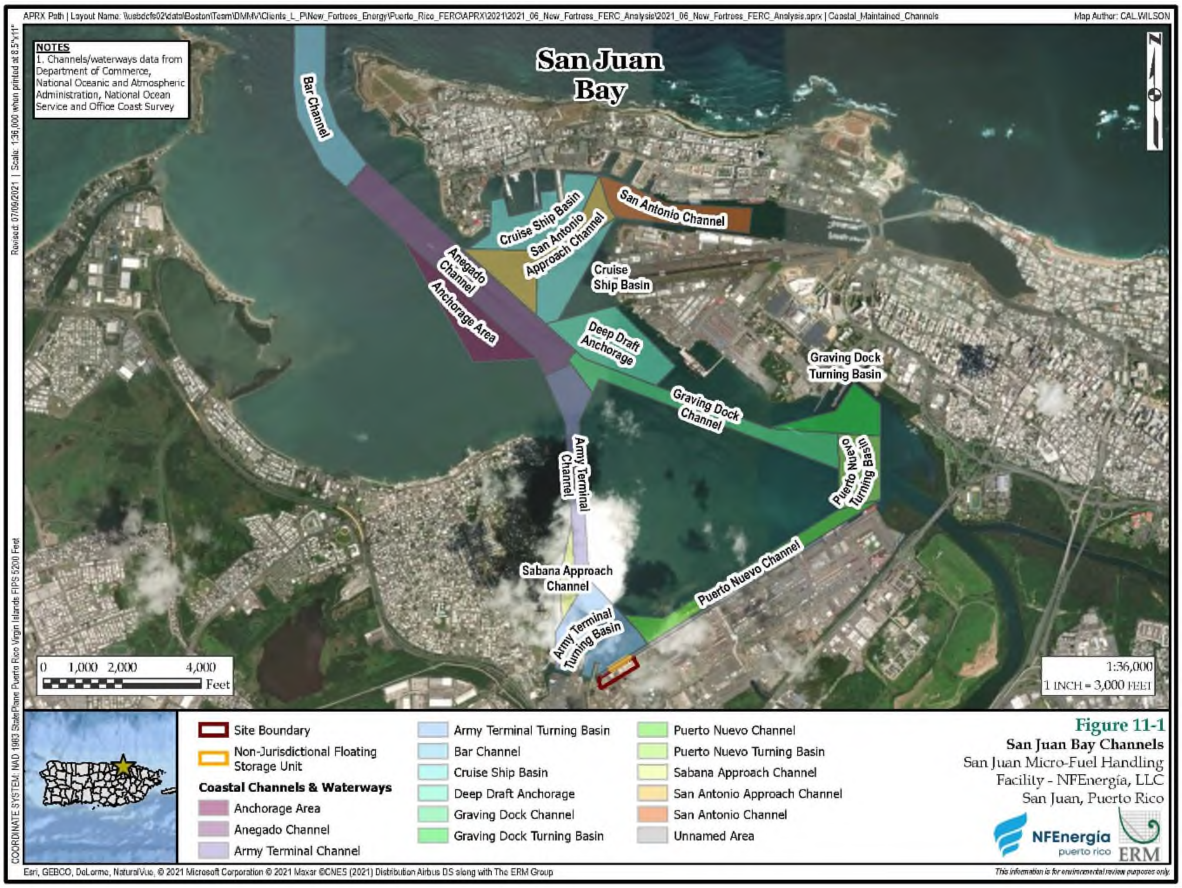
The control building foundation elevation is +6.4 feet.

13.2.1.8 Roads elevation, feet

The truck loading road elevation is between +6.4 and +10.8 feet.

13.2.2 Shipping Channel

Figure 13-2 shows the channels within Bahia de San Juan. All LNG carrier traffic utilizes the Anegado Channel and Army Terminal Channel for transit to and from the marine facilities located along the western edge of the Puerto Nuevo Channel. The entrance channel and the channels inside the harbor are marked by lighted ranges, lights, and lighted and unlighted buoys.



Source: NOAA 25670.

Figure 13-2: Bathymetry at Puerto Nuevo.

Table 13-1 lists the channel dimensions tabulated by the United States Army Corps of Engineers as of 2016.

Table 13-1: Baja San Juan channel dimensions.

Name of Channel	Width (feet)	Length (Nautical miles)	Depth (MLLW feet)
Anegado Channel	800	1.19	40
Army Terminal Channel	350	0.90	40
Graving Dock Channel	350	1.21	36
Puerto Nuevo Channel	350	1.06	39

13.2.2.1 Channel width, feet

Table 13-1 lists the channel widths tabulated by the United States Army Corps of Engineers as of 2016.

13.2.2.2 Channel depth, feet

Table 13-1 lists the channel depths tabulated by the United States Army Corps of Engineers as of 2016.

13.2.2.3 Berth depth, feet

The depth at Wharves A and B is approximately 23-28 feet MLLW.

13.2.2.4 Tidal range elevations, feet

Tidal Datum	Abbreviation	Value (feet MLLW)
Highest Astronomical Tide	HAT	2.24
Mean Higher High Water	MHHW	1.57
Mean High Water	MHW	1.31
Mean Sea Level	MSL	0.76
Mean Low Water	MLW	0.20
Mean Lower Low Water	MLLW	0.00
Lowest Astronomical Tide	LAT	-0.62

13.2.2.5 Channel current (normal, maximum), knots

NOAA National Data Buoy Center ("NDBC") station 41053 provides tidal current information for a period of 6 years (July 2010 to December 2016) for an area offshore of the marine facilities. The prevailing current direction is towards the west-southwest to west-northwest (approximately 40% of the time) and most of the time, currents are slower than 0.2 knots (55.5% of the time). Approximately 0.6% of the time, tidal currents exceed 1 knot. The tidal data, which is provided in the Moffatt & Nichol Basis of Design included as appendix 13B1, shows a relatively small tidal range, therefore, it is not expected that currents will have a significant effect at the location of the project site during operational conditions.

13.2.3 Climatic Conditions

San Juan is located on the northeast coast of the island of Puerto Rico. The climate is tropical marine, slightly modified by insular influences when land breezes blow. Radiative cooling frequently causes land winds at night, consequently, somewhat lower nighttime temperatures occur than would normally be experienced with sea breezes. San Juan has a small annual temperature range, which is a characteristic of all tropical marine climates. The average temperature at San Juan is 81 degrees Fahrenheit ("°F") with an average maximum of 87°F and an average minimum of 75°F.

Details regarding the weather conditions expected at the site are described in the Moffatt and Nichol Basis of Design included in appendix 13B1.

13.2.3.1 Temperature design basis (minimum, average, maximum), °F

The minimum ambient design temperature is 35°F, and the maximum ambient design temperature is 98°F. The average temperatures is between 72 °F and 89 °F.

13.2.3.2 Barometric pressure design basis (minimum, average, maximum), inches mercury (Hg)

The barometric pressure is not explicitly included in the design of the MFH Facility.

13.2.3.3 Barometric pressure rate of increase design basis (minimum, average, maximum), inches of Mercury per hour

The barometric pressure rate of change is not explicitly included in the design of the MFH Facility.

13.2.3.4 Barometric pressure rate of decrease design basis (minimum, average, maximum), inches of Mercury per hour

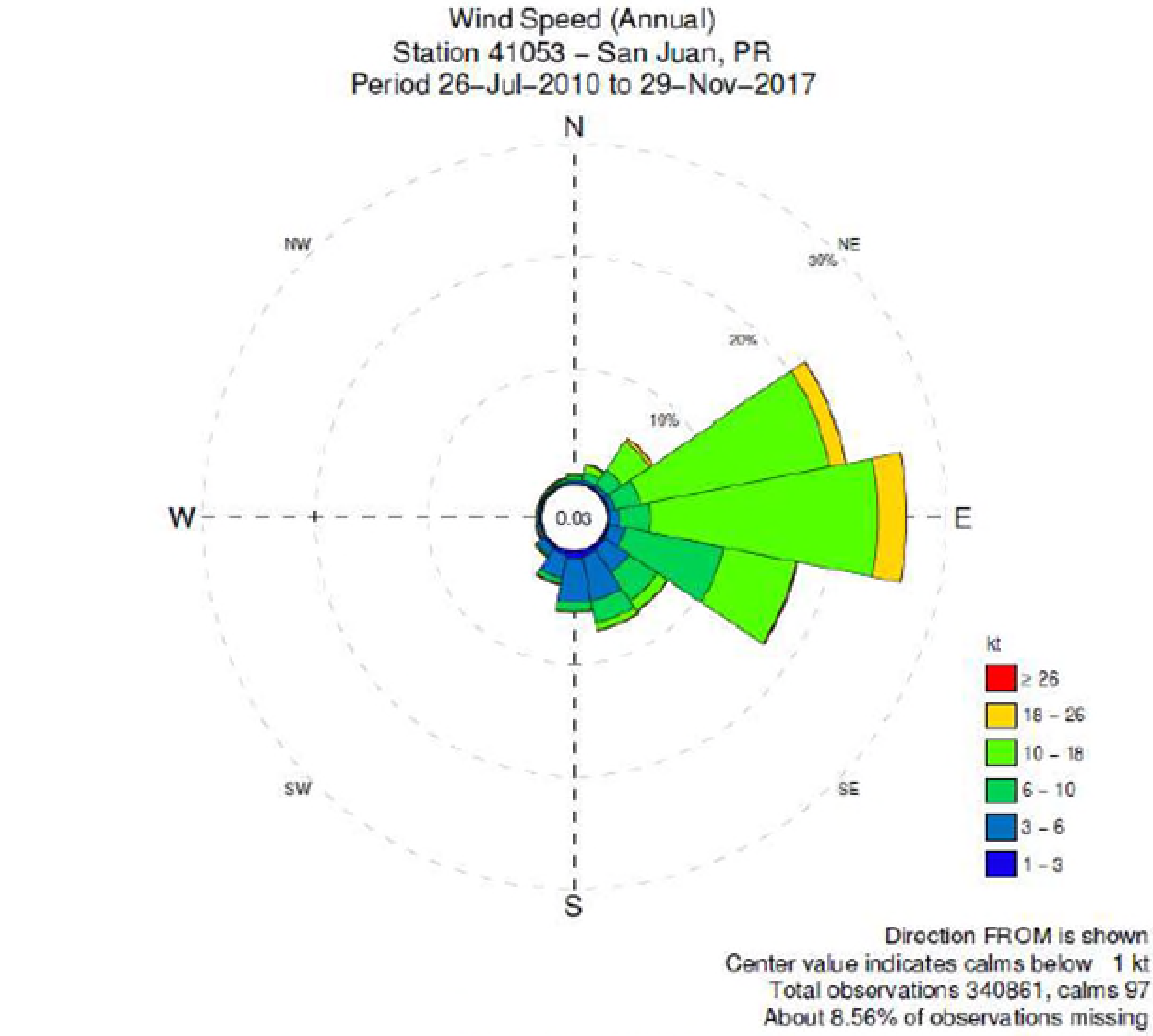
The barometric pressure rate of change is not explicitly included in the design of the MFH Facility.

13.2.3.5 Prevailing wind with seasonal wind rose or charts with 16 radial directions and wind speeds, mph

Data from NDBC station 41053 indicates that prevailing wind directions are from the easterly direction, with east-northeast to east-southeast winds having the highest occurrence, approximately 65% of the time. The highest recorded sustained wind speeds (2-minute) are between 18 to 26 knots, occurring 4.6% of the time. Winds exceed 20 knots approximately 1% of the time.

Data from the Luiz Munoz Marin International Airport, which is located approximately 6 miles east of the Puerto Nuevo terminal, indicates that the prevailing wind directions are between east-northeast and east, which occur 46.1% of the time. Maximum reported wind speed is in the order of 18 to 26 knots, occurring 1.5% of the time.

Figures 13-3 and 13-4 show the wind roses for NDBC 41053 and the Luis Munoz airport, respectively. Details regarding the wind data are described in the Moffatt and Nichol Basis of Design included in appendix 13B1.

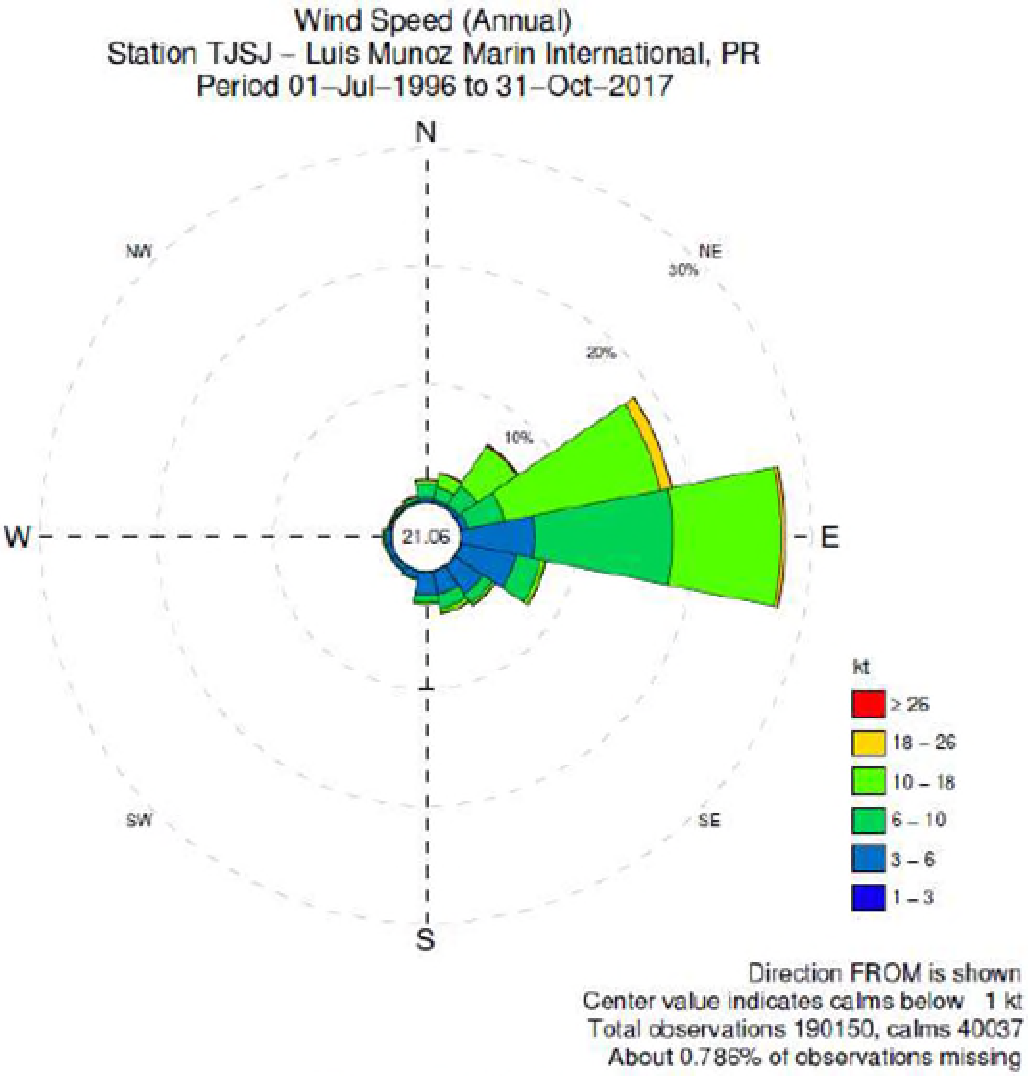


Percentage of Occurrence

Wind Speed, kt	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Total	0.93	1.86	5.44	21.61	26.50	17.21	7.00	7.24	5.42	3.11	1.25	0.55	0.42	0.40	0.46	0.58	99.97
≥ 26																	
18 – 26			0.34	1.46	2.49	0.11											4.55
10 – 18	0.18	0.70	2.98	17.18	20.28	6.60	1.07	0.68	0.14								50.21
6 – 10	0.40	0.68	1.58	2.30	2.72	8.85	3.06	2.01	0.79	0.52	0.21	0.16	0.12	0.11	0.16	0.24	23.91
3 – 6	0.26	0.31	0.43	0.55	0.88	1.47	2.50	4.04	3.89	2.16	0.82	0.24	0.17	0.13	0.14	0.16	18.14
1 – 3				0.12	0.15	0.16	0.33	0.50	0.60	0.36	0.20	0.11					3.09

Source: NOAA 25670.

Figure 13-3: Bathymetry at Puerto Nuevo.



Percentage of Occurrence

Wind Speed, kt	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Total	1.88	2.53	6.50	18.40	27.71	7.46	4.11	3.67	2.80	0.79	0.52	0.52	0.71	0.35	0.38	0.60	78.94
≥ 26																	
18 – 26			0.12	0.99	0.29												1.49
10 – 18	0.38	1.14	4.10	13.56	9.33	0.45	0.30	0.42	0.18							0.11	30.25
6 – 10	1.13	1.10	1.93	3.20	11.76	2.14	0.94	1.23	0.68	0.11			0.19	0.12	0.18	0.33	25.19
3 – 6	0.35	0.25	0.33	0.64	6.32	4.85	2.87	2.01	1.94	0.67	0.44	0.41	0.46	0.14	0.11	0.16	21.96
1 – 3																	

Figure 13-4: Annual Wind Rose at Luis Munoz International Airport.

13.2.3.6 Rain fall rates design basis (100-year return period, 50-year return period, 10-year return period), inches per hour

Rainfall in San Juan Bay is well-distributed throughout the year, with January, February, and March being the driest months and November the rainiest (6.4 inches on average). On a given year, rainfall averages 56.35 inches (1,431.3 mm), falling on an average 198.5 days. Table 13-2 provides the precipitation frequency estimates (in/hr).

Table 13-2: Precipitation frequency estimates for Baja San Juan.

Duration	10-year return	50-year return	100-year return
10 min	5.03	5.88	6.21
60 min	2.56	2.99	3.15
24 hr	0.335	0.475	0.539

13.2.3.7 Snow fall rates design basis (100-year return period, 50-year return period, 10-year period), inches per hour

Snowfall is not explicitly included in the design of the MFH Facility.

13.2.3.8 Frost line depth, feet

The minimum design temperature for the MFH Facility is above freezing, therefore, the frost line is not explicitly included in the design.

13.2.3.9 Visibility frequency and distances, No. fog alerts per year, visibility feet

Visibility data is available at Luis Munoz International Airport. Figure 13-5 presents the histogram of visibility from July 1996 to October 2017. In general, a minimum visibility of 1 nautical mile (approximately 1.15 miles) is considered acceptable for navigation. Based on the data, visibility below 1 mile is recorded only 0.2% of the time.

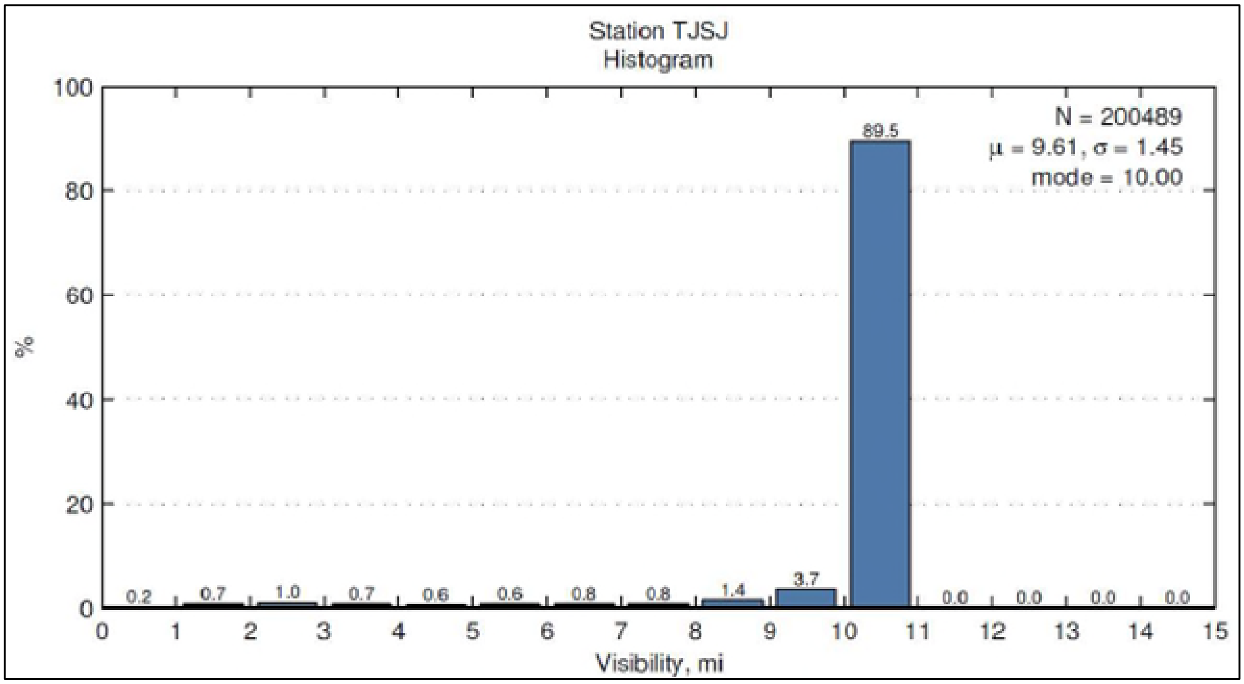


Figure 13-5: Visibility Histogram for Luis Munoz International Airport.

13.2.3.10 Lightning strike frequency, No. per year

The frequency of lightning strikes is not specifically defined for the MFH Facility.

13.2.4 Geotechnical Conditions

The MFH Facility is located at Wharves A and B in Puerto Nuevo Wharf, San Juan Puerto Rico. The surface geology of this area consists of artificial, man-made fill, underlain by soft clayey swamp deposits with occurring sand lenses or pockets of variable thickness, followed by older alluvial and terrace deposits found in consolidated state. The limestone horizon, interpreted to consist of the Cibao formation, occurs at depths of 70 to 80 feet and extends to the bottom of the deepest boring of 120 feet beneath ground surface. Detailed descriptions of the geotechnical conditions are addressed in appendix 13J4.

13.2.4.1 Groundwater conditions

According to the observations made during the subsoil exploration, groundwater was found at depths of 6 to 8 feet beneath the existing paved surface. Groundwater level may rise during and after prolonged rain events and tidal fluctuations. It is interpreted that ground water is within 1-3 feet above mean sea level. Perched ground water will occur within sand pockets overlying clayey soils. Additional descriptions of the groundwater conditions are addressed in appendix 13J4.

13.2.4.2 Soil/rock layer description

The surface geology of San Juan is considered primarily as Artificial by the United States Geological Survey. On-site investigations also found Swamp Deposits, Older Alluvial and Terrance Deposits and Cibeo Formations. These deposits are described below:

- Af—Artificial Fill (Holocene) "Sand, limestone and volcanic rock as fill in valleys, swamps and locally a part of Bahia de San Juan."
- Qs—Swamp Deposits (Holocene) "Sand, muck and clayey sand; generally underlain by peat formed in mangrove swamps. Most areas mapped as artificial fill are underlain by swamp deposits."
- QTt—Older Alluvial and Terrace Deposits (Pleistonce and Pliocene) "Clay, silty and sandy, mainly red or mottled red and light gray."
- Tc—Cibao Formation (Miocene and Oligocene) "Chalk, soft, pale gray limestone and very pale orange sandy clay."

Additional detailed descriptions of the geotechnical conditions are addressed in appendix 13J4.

13.2.4.3 Geotechnical cross-sections

Geotechnical cross-section profiles are presented in the Boring Logs (Boring details) included in appendix 13J4.

13.2.4.4 Soil and rock parameters

Soil and rock parameters used in hazard calculations are addressed in appendix 13I1.

13.3 NATURAL HAZARD DESIGN CONDITIONS

13.3.1 Earthquakes

13.3.1.1 Seismic design basis and criteria for Seismic Category I, II, and III structures, systems and component

Design of all structures is in accordance with International Building Code 2009 and National Fire Protection Association ("NFPA") 59A 2016. Loads are in accordance with American Society of Civil Engineers ("ASCE") / Safety Equipment Institute 7-10. Design of steel structures and members is in accordance with American National Standards Institute / American Institute of Steel Construction 360-16 and American National Standards Institute / American Institute of Steel Construction 341-16. Design of structural concrete and concrete members is in accordance with ACI 318-14.

NFPA 59A defines two levels of earthquake motions: Operating Basis Earthquake ("OBE") and Safe Shutdown Earthquake ("SSE"). OBE and SSE ground motions are determined by site-specific evaluations and are defined in terms of 5 percent damped response spectra.

OBE ground motions are defined as the motion represented by an acceleration response spectrum having a 10 percent probability of exceedance within a 50-year period (mean return interval of 475years).

SSE ground motions are defined as maximum considered earthquake (“MCE”) defined in ASCE 7-05.

Per NFPA 59A 2016 section 5.4.1, Buildings and Structures are classified as A, B or C. Structures classified as A are designed:

- To remain operable during and after an OBE.
- To provide for no loss of containment capability of the primary container of single, double, and full containment tank systems and of the metal liquid barrier of membrane tank systems, and it shall be possible to isolate and maintain the LNG tank systems during and after the SSE.
- For wind, ice, and snow using an occupancy category of IV per ASCE 7.

Structures classified as B are designed for seismic, wind, ice, and snow loads using a risk category of III per ASCE 7. Structures classified as C are designed for seismic, wind, ice, and snow loads using a risk category of II per ASCE 7.

The 2009 edition of the International Building Code was used as a basis for design of all structures, systems, and components not specifically addressed in NFPA 59A.

Seismic Category I structures, as defined by the “Draft Seismic Design Guidelines and Data Submittal for LNG Facilities,” are designed for OBE and SSE ground motions. Seismic Category I structures are designed to remain operable during an OBE event. Seismic Category I structures will consider an importance factor:

I_p=1.0

ASCE 7-05 defines the Design Earthquake (“DE”). Seismic Category II and III structures are to be designed for DE ground motions.

Structures, components, and systems not included in Seismic Category I structures that are required to maintain safe plant operations are classified as Seismic Category II Structures. Seismic Category II Structures will consider an importance factor:

I_p=1.5

Structures, components, and systems not included in Seismic Categories I and II are classified as Seismic Category III Structures. Seismic Category III Structures will consider an importance factor:

I_p=1.0

13.3.1.2 Identification of structures, systems and components classified as Seismic Category I, II, and III

- The following structures, components, and systems at the MFH Facility are classified as Seismic Category I:
  - Suction Drum foundation.
- The following structures, components, and systems are classified as Seismic Category II: Structures, components and systems not included in category I are classified as Seismic Category II. This category includes all other equipment (most mechanical equipment is in this category). This category includes:
  - All other landside structures at the MFH Facility.
- The following structures, components, and systems are classified as Seismic Category III:
  - This category is not applicable to the design of the MFH Facility.

13.3.1.3 MCE site-specific ground motion spectral values for 5% damping

The MCE is described in the Probabilistic Seismic Hazard Analysis ("PSHA") Report as the SSE. See section 13.3.1.5 for further information.

13.3.1.4 DE site-specific ground motion spectral values for 5% damping and ground motion parameters, SDS, SD1, SMS, SM1, TL

The DE is not explicitly defined in the design of the MFH Facility, as per NFPA 59A and ASCE 7-16, the ground motions used in the design are considered more stringent design criterion. Specifically, the foundations and steel structures were designed per NFPA 59A using only the SSE and the OBE.

13.3.1.5 SSE site-specific ground motion spectral values for 5% damping

The following figure is taken from the PHSA Report for the site-specific ground motion spectral values. 5% damping is captured as a gray line.

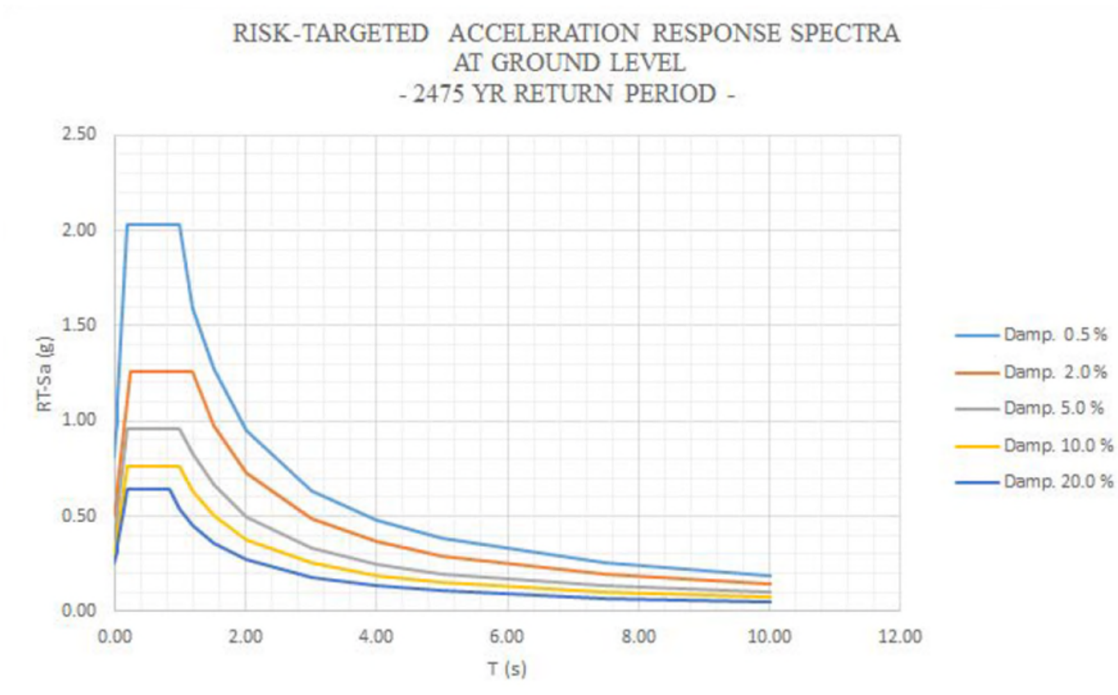


Figure 13-6: SSE Response Spectra.

The SSE is further described in the PSHA Report provided in appendix 13I1.

13.3.1.6 OBE site-specific ground motion spectral values for 5% damping

The following figure is taken from the PHSA Report for the site-specific ground motion spectral values. 5% damping is captured as a gray line.

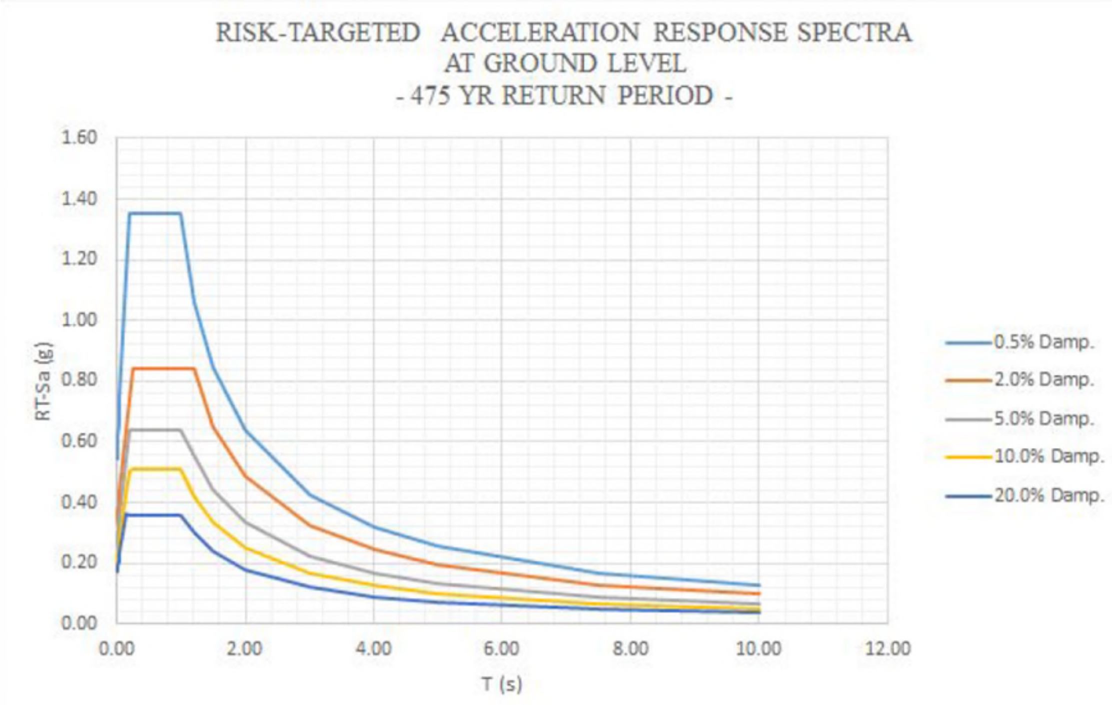


Figure 13-7: OBE Response Spectra.

The OBE is further described in the PSHA Report provided in appendix 13I1.

13.3.1.7 Aftershock level earthquake site-specific ground motion spectral values for 5% damping

The Aftershock level earthquake is not explicitly included in the design of the MFH Facility, as per NFPA 59A and ASCE 7-16, the ground motions used in the design are considered more stringent design criterion. Specifically, the foundations and steel structures were designed per NFPA 59A using only the SSE and the OBE.

13.3.1.8 At locations crossing active faults, design surface fault offsets (horizontal and vertical) and fault orientations

Active faults are described in the PSHA Report provided in appendix 13I1.

13.3.1.9 At locations where crossing growth faults, design offsets for growth faults: Provide design fault offsets for growth faults (horizontal and vertical) for the facility design life and fault orientations

Active faults are described in the PSHA Report provided in appendix 13I1.

13.3.1.10 Ground motions and frequencies of earthquakes at site location

Significant major and great earthquakes in the study region are described in the PSHA Report provided in appendix 13I1.

13.3.1.11 Sloshing freeboard

This is not applicable for the MFH Facility.

13.3.1.12 Ground motion detection systems that alarm and shutdown

The MFH Facility does not currently include a seismic accelerometer capable of recording free field ground motion.

13.3.2 Tsunamis and Seiche

Tsunami and seiche were not considered in the design of the MFH Facility, as there have only been two recordable tsunami and seiche events recorded to affect the island, with the last one occurring in 1918 following a magnitude 7.3 earthquake. A copy of the San Juan, Puerto Rico Tsunami Evacuation Map is included in appendix 13I2. The Emergency Response Plan will be followed if evacuation is necessary.

13.3.2.1 Tsunami and seiche design basis and criteria

This is not applicable for the MFH Facility.

13.3.2.2 Tsunami and seiche design inundation and run-up elevations and corresponding return periods for all structures, systems, and components

This is not applicable for the MFH Facility.

13.3.2.3 Maximum considered tsunami ("MCT"), MCT inundation and run- up elevations for project site, including the MCE level ground motions at the site if the MCE is the triggering source of the MCT

This is not applicable for the MFH Facility.

13.3.2.4 Discussion of inundation and run-up elevations and frequencies of tsunamis and other natural hazards at site location

This is not applicable for the MFH Facility.

13.3.2.5 Design sea level rise: elevation change to be used in design to account for sea level rise at project site for the facility design life

Sea level measurements at San Juan Bay between 1960 and present indicate a 0.082 in/year rising trend. Global mean sea levels are projected to rise by between 0.5 to 3.6 feet by 2070 relative to 1980-1999 levels.

13.3.2.6 Design regional subsidence: elevation change to be used in design to account for regional subsidence at facility site for the facility design life

Regional subsidence is not specifically defined for the MFH Facility.

13.3.2.7 Discussion of co-seismic subsidence/uplift

Co-seismic subsidence/uplift is not specifically defined for the MFH Facility.

13.3.2.8 Discussion of expected settlement over the design life of the facilities

Discussion of the specific effects of settlement are contained in appendix 13I1. Structures deemed to be critical were identified and placed on deep foundations (piles) to reduce the potential for settlement.

13.3.3 Hurricanes and Other Meteorological Events

A copy of the MFH Facility's Hurricane and Severe Weather Procedure is included in appendix 13I3. This procedure details, among other things, the key responsible parties of the MFH Facility personnel, a decision matrix, and detailed plans for the readiness, alert, facility shutdown, evacuation, strike and recovery from a hurricane or other similar severe weather event.

13.3.3.1 Wind and storm surge design basis and criteria

Storm surge refers to the increase in water level above daily tidal fluctuations during a storm event. Surge may include effects from barometric pressure, wind stress, and dynamic wave setup. Storm surge information was taken from the Federal Emergency Management Agency Flood Insurance Study ("FIS"), which consists of a compilation and presentation of flood risk data for specific coastal flood hazard areas within a community. The FIS for Puerto Rico was completed in November 2009 and contains information relative to storm surge for 10-, 50-, 100- and 500-year return periods, as summarized in table 13-3.

Table 13-3: Extreme Water Levels from Puerto Rico FIS referenced to MSL.

Return Period (years)	Storm Surge (feet)
10	2.0
25	3.4
50	4.3
100	5.6
500	8.2

13.3.3.2 Identification of design wind speeds (sustained and 3-second gusts) and corresponding return periods, wind importance factors, and storm surge design elevations for all structures, systems, and components

The MFH Facility is designed to withstand a sustained wind velocity of 170 miles per hour in accordance with ASCE 7-10. Additionally, in accordance with ASCE 7-10, a Risk Category IV and Exposure Class were included in the design. Further, the design considered that this wind load will be acting in both axes separately.

13.3.3.3 Sea level rise: elevation change to be used to account for sea level rise at the site for the design life

See section 13.3.2.6 for details on sea level rise.

13.3.3.4 Regional subsidence: elevation change to be used to account for regional subsidence at the site for the design life

See section 13.3.2.7 for details on regional subsidence.

13.3.4 Tornadoes

13.3.4.1 Wind speed design basis and criteria

Tornadoes were not considered in the design of the MFH Facility.

13.3.4.2 Identification of design wind speeds (sustained and 3-second gusts) and corresponding return periods, and wind importance factors for all structures, systems, and components

Tornadoes were not considered in the design of the MFH Facility.

13.3.5 Floods

13.3.5.1 Flood design basis and criteria

The FEMA Base Flood Elevation is 11.15 ft. Figure 13-8 shows the flood hazard classification for the MFH Facility and surrounding areas. The MFH Facility site will not be raised above the FEMA Base Flood Elevation.

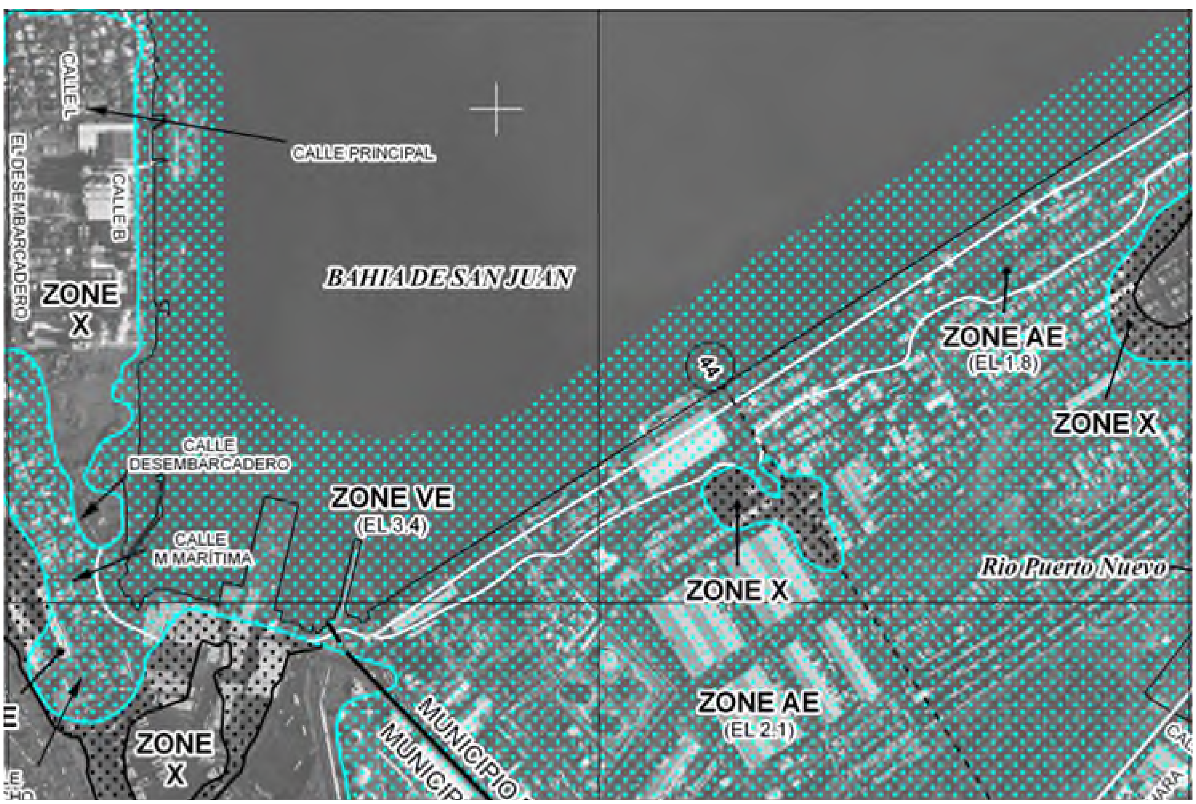


Figure 13-8: Flood Hazard Classification.

Further information is contained in appendix 13B1.

13.3.5.2 Identification of stream flows and flood design elevations and corresponding return periods for all structures, systems, and components

This information is contained in appendix 13B1.

13.3.5.3 Discussion of streamflows, flood elevations, and frequencies of floods and other natural hazards at site location

This information is contained in appendix 13B1.

13.3.6 Rain, Ice, Snow, and Related Events

13.3.6.1 Rainfall design basis and criteria

Rainfall during the 100-year storm data generates the following amounts of rain: a) 3.15 inches per hour and b) 12.94 inches per day.

13.3.6.2 Ice load design basis and criteria

Ice loads were not considered in the design of MFH Facility.

13.3.6.3 Snow load design basis and criteria

Snow loads were not considered in the design of MFH Facility.

13.3.6.4 Identification of snow and ice loads and corresponding return periods for all structures, systems, and components, including snow removal for spill containment systems

Snow and ice loads were not considered in the design of MFH Facility.

13.3.6.5 Identification of stormwater flows, outfalls, and stormwater management systems for all surfaces, including spill containment system sump pumps

The MFH Facility is built upon a preexisting site with no changes to the existing drainage or stormwater system. This preexisting system sheet flows from the north half of the MFH Facility into the bay, whereas the south half sheet flows to drainage catchments, where stormwater is conveyed into the Port's existing stormwater system. A containment area, trench system and impoundment sump have been added to the MFH Facility, designed in compliance with NFPA 59A-2016.

13.3.6.6 Discussion of snow and ice formation and frequencies of blizzards and other snow and ice events at site location

Snow and ice were not considered in the design of MFH Facility.

13.3.7 Other Natural Hazards

Other natural hazards were not considered in the design of MFH Facility.

13.3.7.1 Design basis and criteria

This is not applicable for the MFH Facility.

13.3.7.2 Identification of loads and corresponding return periods for all structures, systems, and components

This is not applicable for the MFH Facility.

13.3.7.3 Discussion of natural hazards and frequencies of natural hazards at site location

This is not applicable for the MFH Facility.

13.4 MARINE FACILITIES

A Letter of Recommendation dated September 26, 2018 was issued for the MFH Facility and is included in Resource Report 11. The Captain of the Port determined that the San Juan Bay transit route is suitable for the type and frequency of marine traffic associated with this project.

13.4.1 LNG Vessels

The MFH Facility's marine berth is designed to accommodate shuttle vessels with capacity up to 30,000 m3. Tables 13-4 and 13-5 present typical shuttle vessel and FSU dimensions.

Table 13-4: Shuttle vessel Dimensions.

LNG Carrier Name	Containment Type	Cargo Volume (m^3)	Gross Tonnage (megaton)	LOA (m)	Beam (m)	Laden Draft (m)	Longitudinal Ballast Windage (m^2)
Coral Energy	Type C	15,288	13,501	155.0	22.7	7.35	1944
Coral Encanto	Type C	29,400	26,279	181.3	28.0	8.00	1105

Table 13-5: FSU vessel Dimensions.

FSU Name	Containment Type	Cargo Volume (m^3)	Gross Tonnage (megaton)	LOA (m)	Beam (m)	Laden Draft (m)	Longitudinal Ballast Windage (m^2)
JS Ineos	Type C	27,554	22,887	180.3	26.6	9.40	2205

13.4.1.1 Shipping route within United States waters

Shuttle vessels transiting between the Caribbean Sea and the MFH Facility will transit through roughly 6 nautical miles of the San Juan Bay. Prior to entering the San Juan Bay, the shuttle vessels will embark a marine pilot at the Sea Buoy. The vessels will then proceed to the MFH Facility under the direction of the pilot.

13.4.1.2 Ship traffic

A recent analysis of marine traffic in San Juan Bay (2017) indicates an annual average of 3,954 vessels transiting the San Juan Bay. These vessels consist of deep draft, passenger vessels, cruise ships, tugs and barges, as well as recreational and smaller size fishing boats.

13.4.1.3 Ship simulations

A set of Ship Maneuvering Simulations, including detailed berthing for the FSU, was performed using full mission bridge maneuvering to assess the feasibility of the project 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.

13.4.1.4 Tug services, owned/leased

Tug services are chartered by the MFH Facility to escort inbound and outbound movements of the LNG carriers.

13.4.1.5 Tug services, full time/as required

NFEnergía is required to have two escort tugs and a United States Coast Guard security escort from the main entrance of the bay (located near the breakwater at El Morro) to the MFH Facility marine berth for inbound movement, and the same for outbound movement from the MFH Facility to El Morro.

13.4.1.6 Aids to navigation

The MFH Facility is within the Port of San Juan, therefore, no further aids to navigation were required.

13.4.1.7 LNG vessel size

See section 13.4.1 for details on LNG shuttle vessel size.

13.4.1.8 LNG vessel draft

See section 13.4.1 for details on LNG shuttle vessel draft.

13.4.1.9 LNG vessel cargoes design and operating conditions and specifications for unloading and vapor recovery:

The liquid unloading lines has discharge pressure between 71 pounds per square inch gauge ("psig"; full-open) and 94 psig (full-closed), dependent upon the position of the discharge valve.

Vapor return is by free flow; vapor rates will depend on the offload rate, with a maximum rate of 1620 m3/hr. No vapor recovery on the vessel, excess vapor is sent to the MFH Facility or burned if transfer is not possible.

13.4.1.10 Molecular weight, higher heating value, lower heating value, Wobbe, specific gravity, equilibrium temperature (°F) and cargo pressure (psig), composition

Table 13-6 lists the expected molecular weight, higher heating value ("HHV"), lower heating value ("LHV"), Wobbe, specific gravity, equilibrium temperature (°F) and cargo pressure (psig), composition.

Table 13-6: Typical LNG Parameters.

Molecular Weight	16.99
HHV (British Thermal Unit / scf)	1,056.3
LHV (British Thermal Unit / scf)	952.7
Wobbe No.	1370.71
Specific Gravity	1.5
Equilibrium Temperature (°F)	-260°F
Cargo Pressure (psig)	65
Nitrogen Content (mol%)	0.31
Methane Content (mol%)	93.29
Butanes and Heavier Content (mol%)	0.01
Pentanes and Heavier Content (mol%)	< 0.01

13.4.1.11 LNG vessel cargoes design and operating conditions and specifications for loading and vapor recovery:

This is not applicable for the MFH Facility.

13.4.1.12 Cargoes' molecular weight, HHV, LHV, Wobbe, specific gravity, equilibrium temperature (°F) and cargo pressure (psig), composition

See 13.4.1.10 for further information.

13.4.1.13 LNG vessel pump design pressure range, psig

The pump design pressure range for the FSU are listed in table 13-7.

No booster pump is present on the FSU.

Table 13-7: FSU Pumps Design Pressure Range.

	Minimum Operating Discharge Pressure (psig)	**Operating Discharge Pressure (psig)**	**Maximum Operating Discharge Pressure (psig)**
Cargo Pump	116	116-160	160

13.4.1.14 LNG vessel pump design rates, gpm

The pump design rates for the FSU are listed in table 13-8.

Table 13-8: FSU Pumps Design Rates.

	Minimum Operating Flow Rate (gpm)	Operating Flow Rate (gpm)	Maximum Operating Flow Rate (gpm)
Cargo Pump	120	120-1190	1190

13.4.2 Marine Platform Design

The FSU is semi-permanently moored at the marine berth, which is located onshore at the water's edge of the MFH Facility. The marine berth includes four cone fenders, four quad quick-release hooks ("QRH") and two double QRHs for the mooring and securing and the FSU to the marine berth.

The marine berth is a steel-jacketed, pile-supported platform with a surface area of 221 feet by 34 feet, on which the unloading system package, gangway, and safety systems are located.

13.4.2.1 Wave crests and periods, feet

The prevailing wave directions offshore are on the north-northeast to east-northeast sector, occurring approximately 80% of the time. Half of these have a significant wave height below 3.3 feet and less than 10% have a significant wave height greater than 6.2 feet. The peak period is between 7 and 10 seconds. Further information is contained in appendix 13B1.

13.4.2.2 Prevailing currents (normal, maximum), knots

The MFH Facility is located near the south corner of the Port of San Juan, therefore it is not subject to currents.

13.4.2.3 Tidal range elevations, feet

See section 13.2.2.4 for Tidal Range Elevations.

13.4.2.4 Water depth at berth and in approach channel, feet

See section 13.2.2.2 for Water Depth.

13.4.2.5 LNG carrier capacity range, m3

See section 13.4.1 for shuttle vessel capacity range.

13.4.2.6 LNG carrier approach velocity, knots

The LNG shuttle vessel approach velocity is limited to 5 knots while in the Port of San Juan.

13.4.2.7 LNG carrier approach angle, degrees

The LNG shuttle vessel approach angle is not explicitly defined for the MFH Facility.

13.4.2.8 LNG carrier unloading frequency, per year

The MFH Facility LNG shuttle vessel unloading frequency is 120 per year.

13.4.2.9 LNG carrier unloading duration, hours

The MFH Facility LNG shuttle vessel unloading duration is 24-hours per received vessel.

13.4.2.10 LNG carrier loading frequency, per year

This is not applicable for the MFH Facility.

13.4.2.11 LNG carrier loading duration, hours

This is not applicable for the MFH Facility.

13.4.2.12 LNG carrier port time, pilot on to pilot off, hours

The LNG shuttle vessel port time is 30 to 36 hours.

13.4.2.13 Barge capacity range, m3

This is not applicable for the MFH Facility.

13.4.2.14 Barge approach velocity, knots

This is not applicable for the MFH Facility.

13.4.2.15 Barge approach angle, degrees

This is not applicable for the MFH Facility.

13.4.2.16 Barge unloading frequency, per year

This is not applicable for the MFH Facility.

13.4.2.17 Barge unloading duration, hours

This is not applicable for the MFH Facility.

13.4.2.18 Barge loading frequency, per year

This is not applicable for the MFH Facility.

13.4.2.19 Barge loading duration, hours

This is not applicable for the MFH Facility.

13.4.2.20 Turning basin depth and radius, feet

The Army Terminal Turning Basin connects the Army Terminal Channel (primary approach channel) and the Puerto Nuevo Channel (connecting to the MFH Facility marine berth). The turning basin radius is 607.5 feet, and the depth is 40 feet (MLLW).

13.4.2.21 Marine platform location/spacing

The MFH Facility has a single marine platform, which is located at the Army Terminal Turning Basin in Puerto Nuevo, Puerto Rico.

13.4.2.22 Jetty/trestle configuration

The marine platform is onshore, therefore there is no jetty or trestle at the MFH Facility.

13.4.2.23 Number and design of berths*

The MFH Facility has a single marine berth constructed of precast concrete panels and steel-jacketed pile supports.

13.4.2.24 Number and design of hooks, quick-release hooks*

There are four Trelleborg 75T quad QRHs with remote release and integral capstans, and two Trelleborg 75T double QRHs with remote release.

13.4.2.25 Number and design of capstans*

The capstans are integrated into the four quad QRHs.

13.4.2.26 Number and design of fenders*

There are four cone fenders located at the marine berth.

13.4.2.27 Number, arrangement, and design of breasting dolphins*

This is not applicable for the MFH Facility.

13.4.2.28 Number, arrangement, and design of mooring dolphins*

This is not applicable for the MFH Facility.

13.4.2.29 Current monitors

This is not applicable for the MFH Facility.

13.4.2.30 Vessel approach velocity monitors

This is not applicable for the MFH Facility.

13.4.2.31 Tension monitors

This is not applicable for the MFH Facility.

13.4.2.32 Marine platform other safety features

This is not applicable for the MFH Facility.

13.4.3 Marine Transfer Design

The MFH Facility includes two marine transfer steps:

1. LNG ship-to-ship ("STS") transfer, between the LNG shuttle vessel and the FSU; and
2. LNG transfer between the FSU and the MFH Facility.

13.4.3.1 LNG arms or hoses and size per dock, No., in

The STS transfer includes four 8-inch diameter composite hoses for the transfer of LNG. Each hose is 60 feet long.

The FSU unloading includes two 8-inch diameter composite hoses for the transfer of LNG to the onshore equipment. Each hose is 60 feet long.

13.4.3.2 Vapor arms or hoses and size per dock, No., in

The STS transfer includes two 8-inch diameter composite hoses for the transfer of LNG vapors. The hoses used for the vapor transfer are interchangeable with the hoses used for liquid transfer.

The FSU unloading includes one 8-inch diameter composite hose for the transfer of LNG vapors.

13.4.3.3 Hybrid arms or hoses and size per dock, No., in

There are no hybrid arms or hoses installed at the MFH Facility.

13.4.3.4 LNG arms or hoses operating and design flow rate capacities (minimum, normal, maximum), gpm

[redacted]

13.4.3.5 LNG arms or hoses operating and design pressures (minimum, normal, maximum), psig

[redacted]

13.4.3.6 LNG arms or hoses operating and design temperatures at ship manifold (minimum, normal, maximum), °F

[redacted]

13.4.3.7 Vapor arms or hoses operating and design flow rate capacities (minimum, normal, maximum), pounds per hour

[redacted]

13.4.3.8 Vapor arms or hoses operating and design pressures at ship manifold (minimum, normal, maximum), psig

[redacted]

13.4.3.9 Vapor arms or hoses operating and design temperatures at ship manifold (minimum, normal, maximum), °F

[redacted]

Marine transfer startup and operation

Marine transfer custody transfer

Custody transfer will occur at the LNG shuttle vessel flange.

Marine transfer measurement and analysis

All measurements and analysis of the marine transfer operation are passed from the FSU and then from the FSU to the MFH Facility through wireless communication. Communication to shore is between the cargo control room on the FSU and the MFH Facility distributed control system ("DCS") in the control room.

Unloading and/or loading

Unloading operations occur from the LNG Carrier to the FSU, and then from the FSU to the MFH Facility. There are no marine loading operations at the MFH Facility.

Recirculating system

This is not applicable for the MFH Facility.

Vapor return handling

Any vapor from the FSU flows to the boil-off gas ("BOG") Compressor and then on to the sendout metering system.

Vapor return desuperheating

This is not applicable for the MFH Facility.

13.4.3.10 Marine transfer shutdown

The MFH Facility has shutoff valves and an emergency shutdown ("ESD") system installed on the incoming liquid and vapor lines.

13.4.3.11 Marine transfer piping, vessel, and equipment design and specifications

The design and specifications for the marine transfer system can be found in appendix 13F.

13.4.3.12 Marine transfer isolation valves, vents, and drains

Isolation valves are provided on both ends of the unloading hoses. These valves will be used during maintenance when isolation will be required between the MFH Facility and the shoreside equipment.

Further information on isolation, vents and drains can be found on drawings in appendix 13E5. The Isolation Philosophy can be found in appendix 13B2.

13.4.3.13 Marine transfer basic process control systems ("BPCS")

The ship-to-shore operation is manned, with both vessels (LNG shuttle vessel and FSU) and the MFH Facility connected through the ship-to-shore connection.

13.4.3.14 Marine transfer safety instrumented systems

In the event of a safety instrumented system ("SIS") triggering event, the SIS system shall initiate shutdown valves to isolate the unloading operation as described in appendix 13Q.

13.4.3.15 Marine transfer relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Thermal reliefs are included on piping where cryogenic fluid can be blocked in. Further information is provided in appendix 13R1 and 13R2.

13.4.3.16 Marine transfer other safety features

[redacted]

[redacted]

[redacted]

Safe working envelope of transfer arms

There are no transfer arms on the MFH Facility marine berth; only flexible hoses are utilized for unloading operations.

Powered Emergency Release Coupling valves

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Ship/shore communication and shutdown capability

Portable radios and cell phones are currently used for ship-to-shore verbal communications.

Marine transfer operation data is passed from the FSU to the MFH Facility through wireless communication. Data is visible to operators in the control room.

Emergency shutdown capability from shore is available via a ship-to-shore link. The link includes three types of communications between the MFH Facility control room and the FSU control room: fiber-optic, pneumatic, and electrical.

13.5 FEED GAS

This is not applicable for the MFH Facility.

13.6 FEED GAS PRETREATMENT

This is not applicable for the MFH Facility.

13.7 NATURAL GAS LIQUIDS REMOVAL, STORAGE, AND DISPOSITION

This is not applicable for the MFH Facility.

13.8 HEAVIES/CONDENSATES, STORAGE, AND DISPOSITION

This is not applicable for the MFH Facility.

13.9 LIQUEFACTION SYSTEM

This is not applicable for the MFH Facility.

13.10 LNG PRODUCT TRANSFER TO STORAGE

This is not applicable for the MFH Facility.

13.11 LNG STORAGE TANKS

This is not applicable for the MFH Facility.

13.12 VAPOR HANDLING

13.12.1 Vapor Handling Design

Vapors may be produced from various sources/operations of the MFH Facility. The main sources of vapor are BOG from the FSU and returned vapor from truck loading.

The MFH Facility will receive vapor from the FSU. The FSU will not send vapor ashore during emergency scenarios (onshore or offshore) or during an STS transfer. The following table describes the conditions downstream of the unloading hose at the MFH Facility battery limits.

Table 13-9: Vapor Handling System Parameters.

Component	Design Conditions	From FSU Compressor[1]	Free Flow
Pressure[4], psig (barg)	[redacted]	[redacted]	[redacted]
Temperature4, °F	[redacted]	[redacted]	[redacted]
Flowrate, lb/h		[redacted]	[redacted]
[redacted]			

13.12.1.1 Vapor return blowers type

This is not applicable for the MFH Facility.

13.12.1.2 Number of vapor return blowers, operating and spare

This is not applicable for the MFH Facility.

13.12.1.3 Vapor return blowers operating and design flow rate capacities (minimum, normal/rated, maximum), lb/hr

This is not applicable for the MFH Facility.

13.12.1.4 Vapor return blowers operating and design suction pressures (minimum, normal/rated, maximum), psig

This is not applicable for the MFH Facility.

13.12.1.5 Vapor return blowers operating and design suction temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.12.1.6 Vapor return blowers operating and design discharge pressures (minimum, normal/rated, maximum/shutoff), psig

This is not applicable for the MFH Facility.

13.12.1.7 Vapor return blowers operating and design discharge temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.12.1.8 BOG low pressure compressors type

[redacted]

13.12.1.9 Number of BOG low pressure compressors, operating and spare

[redacted]

13.12.1.10 BOG low pressure compressors operating and design flow rate capacities (minimum, normal/rated, maximum), lb/hr

[redacted]

13.12.1.11 BOG low pressure compressors operating and design suction pressures (minimum, normal/rated, maximum), psig

[redacted]

13.12.1.12 BOG low pressure compressors operating and design suction temperatures (minimum, normal, maximum), °F

[redacted]

13.12.1.13 BOG low pressure compressors operating and design discharge pressures (minimum, normal/rated, maximum/shutoff), psig

[redacted]

13.12.1.14 BOG low pressure compressors operating and design discharge temperatures (minimum, normal, maximum), °F

[redacted]

13.12.1.15 BOG high pressure compressors type

This is not applicable for the MFH Facility.

13.12.1.16 Number of BOG high pressure compressors, operating and spare

This is not applicable for the MFH Facility.

13.12.1.17 BOG high pressure compressors operating and design flow rate capacities (minimum, normal/rated, maximum), lb/hr

This is not applicable for the MFH Facility.

13.12.1.18 BOG high pressure compressors operating and design suction pressures (minimum, normal/rated, maximum), psig

This is not applicable for the MFH Facility.

13.12.1.19 BOG high pressure compressors operating and design suction temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.12.1.20 BOG high pressure compressors operating and design discharge pressures (minimum, normal/rated, maximum/shutoff), psig

This is not applicable for the MFH Facility.

13.12.1.21 BOG high pressure compressors operating and design discharge temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.12.1.22 Vapor handling startup and operation

Vapor return blowers to or from the LNG vessel

This is not applicable for the MFH Facility.

BOG low pressure compression

Refer to the BOG Low Pressure Compressor for relevant information.

BOG high pressure compression, including BOG holding mode compression to pipeline

This is not applicable for the MFH Facility.

BOG utilization

The BOG compressor is utilized intermittently, or infrequently.

13.12.1.23 Vapor handling isolation valves, drains, and vents

This is not applicable for the MFH Facility.

13.12.1.24 Vapor handling BPCS

This is not applicable for the MFH Facility.

13.12.1.25 Vapor handling SISs

This is not applicable for the MFH Facility.

13.12.1.26 Vapor handling relief valves and discharge

This is not applicable for the MFH Facility.

13.12.1.27 Vapor handling other safety features

No other safety features have been identified for the MFH Facility.

13.12.2 BOG Re-Condensation Design

This is not applicable for the MFH Facility.

13.13 LNG PUMPS

13.13.1 LNG Tank/Low Pressure Pump Design

This is not applicable for the MFH Facility.

13.13.2 LNG Sendout/High Pressure System Design

13.13.2.1 LNG High Pressure pumps type

[redacted]

13.13.2.2 Number of LNG HP pumps, operating and spare

[redacted]

13.13.2.3 LNG HP pumps operating and design flow rate capacities (minimum, normal/rated, maximum), gpm

[redacted]

13.13.2.4 LNG HP pumps operating and design suction pressures (minimum / Net Positive Suction Head, normal/rated, maximum), psig

[redacted]

13.13.2.5 LNG HP pumps operating and design suction temperatures (minimum, normal, maximum), °F

[redacted]

13.13.2.6 LNG HP pumps operating and design discharge pressures (minimum, normal/rated, maximum/shutoff), psig

[redacted]

13.13.2.7 LNG HP pumps operating and design discharge temperatures (minimum, normal, maximum), °F

[redacted]

13.13.2.8 LNG HP pumps operating and design densities (minimum, normal, maximum), specific gravity

[redacted]

13.13.2.9 LNG HP pumps startup and operation

LNG pump to vaporization

[redacted]

LNG pump minimum flow recycle

[redacted]

13.13.2.10 LNG HP pumps isolation valves, drains, and vents

[redacted]

13.13.2.11 LNG HP pumps BPCS

[redacted]

LNG pump flow control

[redacted]

13.13.2.12 LNG HP pumps SISs

[redacted]

13.13.2.13 LNG HP pumps relief valves and discharge

[redacted]

13.13.2.14 LNG HP pumps other safety features

No other safety features for the LNG truck loading bays have been identified.

13.14 LNG TRUCKING

The MFH Facility has the capability to both vaporize LNG and load LNG into trucks. LNG supply will be prioritized to maintain full required flow to the vaporization process.

13.14.1 LNG Trucking Design

The LNG truck loading system has a 33,000-gallon suction drum to stabilize the line pressure to the loading rack, which is comprised of two (2) transfer pumps rated at 400 gpm each. Each transfer pump supplies two (2) bays. LNG supply to the truck loading system is designed for up to 800 gpm (4 bays x 200 gpm per truck lane/bay) with lower flow allowed for system and tanker cool down rates. Each of the four (4) LNG truck loading lanes is equipped with a weigh scale to meter the amount of LNG loaded.

Empty LNG trucks enter the MFH Facility from the west, are directed past a turn-around to make a left turn into the LNG truck loading area and are assigned to one of the LNG truck loading lanes for loading operations. The loading operation for one (1) LNG truck takes approximately 54 minutes. Once weight is confirmed, the truck exits the MFH Facility to the west.

13.14.1.1 Number of LNG trucks unloaded, No. per year

This is not applicable for the MFH Facility.

13.14.1.2 LNG truck unloaded capacities, gal

This is not applicable for the MFH Facility.

13.14.1.3 Number of LNG trucks loaded, No. per year

Truck loading data indicates 35 trucks were loaded in 2020 (with first truck loading on August 20) and 219 trucks have been loaded in 2021 (through August 31).

13.14.1.4 LNG truck loaded capacities, gal

The LNG truck loading size design is 13,100 gal of LNG (Iso-Containers High Capacity) or 11,400 gal of LNG (High-Capacity Tank).

The MFH Facility has loaded a total of 254 trucks since truck loading operations began in August 2020, for a total of approximately 2.58 million US gal of LNG (average of 10,140 US gal per truck).

13.14.1.5 Number of LNG truck stations

The MFH Facility includes four (4) LNG truck stations or loading bays/lanes.

13.14.1.6 LNG truck scales

A certified truck scale is provided in each of the four (4) LNG truck loading bays/lanes.

13.14.1.7 LNG truck unloading operating and design flow rate capacities (minimum, normal, maximum), gpm

This is not applicable for the MFH Facility.

13.14.1.8 LNG truck loading operating and design flow rate capacities (minimum, normal, maximum), gpm

	Minimum Operating / Design Flow Rate (gpm)	**Maximum Operating / Design Flow Rate (gpm)**
LNG Truck Loading Stations (each)	172 / 200	688 / 3500

13.14.1.9 LNG truck unloading operating and design pressures (minimum, normal, maximum), psig

This is not applicable for the MFH Facility.

13.14.1.10 LNG truck loading operating and design pressures (minimum, normal, maximum), psig

	Minimum Operating / Design Pressure (psig)	**Design Operating Pressure (psig)**	**Maximum Operating / Design Pressure (psig)**
LNG Truck Loading Stations (each)	43.5 / 60	70	145 / 275

13.14.1.11 LNG truck unloading operating and design temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.14.1.12 LNG truck loading operating and design temperatures (minimum, normal, maximum), °F

	Minimum Operating / Design Temperature (°F)	**Maximum Operating / Design Temperature (°F)**
LNG Truck Loading Stations (each)	-256 / -320	-215 / -100

13.14.1.13 LNG truck pumps type

The LNG truck loading pumps are vertical, centrifugal type.

13.14.1.14 Number of LNG truck pumps, operating and spare

The MFH Facility has two LNG truck loading pumps rated at 400 gpm. Both pumps are used intermittently for the truck loading operation.

13.14.1.15 LNG truck pumps operating and design flow rate capacities (minimum, normal/rated, maximum), gpm

See section 13.14.1.8 for LNG truck pump flow rate details.

13.14.1.16 LNG truck pumps operating and design suction pressures (minimum / Net Positive Suction Head, normal/rated, maximum), psig

See section 13.14.1.10 for LNG truck pump suction pressure details.

13.14.1.17 LNG truck pumps operating and design discharge pressures (minimum, normal/rated, maximum/shutoff), psig

See section 13.14.1.10 for LNG truck pump discharge pressure details.

13.14.1.18 LNG truck pumps operating and design densities (minimum, normal, maximum), specific gravity

The specific gravity of the LNG and vaporized LNG in the MFH Facility are 0.425 and 1.5, respectively.

13.14.1.19 LNG trucking startup and operation

LNG loading

LNG is loaded into the International Organization for Standardization-Containers or High-Capacity Tanks through a 3-inch connection at 200 gpm.

LNG unloading

This is not applicable for the MFH Facility.

Vapor handling

[redacted]

13.14.1.20 LNG trucking piping, vessel, and equipment design and specifications

The LNG trucking piping, vessel, and equipment were designed in accordance with the applicable codes and standards. Further information is found in appendices 13B1, 13D1, and 13E5.

13.14.1.21 LNG trucking isolation valves, drains, and vents

This system is isolatable through a series of manual valves and depressurization lines for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

13.14.1.22 LNG trucking BPCS

The LNG truck loading bays are remotely operated through the plant DCS. Plant alarms shall alert operations to out of bound conditions set by the equipment manufacturer. Further information is found in appendices 13E5 and 13Q1.

13.14.1.23 LNG trucking SISs

In the event of an SIS-triggering event, the SIS system shall initiate shutdown valves to stop the truck loading operation as described in appendices 13E5 and 13Q1.

13.14.1.24 LNG trucking relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Thermal reliefs are included on piping where cryogens can be blocked in. Further information is provided in appendix 13R1.

13.14.1.25 LNG trucking other safety features

Each LNG truck connection is equipped with dry break couplings to minimize potential spills during normal truck loading operations.

13.15 LNG VAPORIZATION

13.15.1 LNG Vaporizers Design

The operating vaporizers are gas-fired, and they use a water bath design. There is a future tie-in connection for a shell-and-tube heat exchanger on each vaporization package.

The vaporizer has a design capacity of 65 MMscfd.

An ambient air vaporizer provides the required fuel gas flow for the gas-fired heaters during startup.

13.15.1.1 Emission design criteria

The MFH Facility has a total of two 60,000 scf/hr natural gas-fed heaters with an annual operating design of 8,760 hours per year, for a total annual fuel burn rate of 525,600,000 standard cubic feet per year. Further emission design data is contained in Resource Report 9.

13.15.1.2 LNG vaporizers type

The vaporizers are gas-fired, water bath type.

13.15.1.3 Number of LNG vaporizers, operating and spare

There are two (2) LNG vaporizer packages at the MFH Facility; both packages are operating. Each package contains a spare burner and blower.

13.15.1.4 LNG vaporizers operating and design flow rate capacities (minimum, normal, maximum), MMscfd

The design flow rate of the LNG vaporizers is 65 MMscfd each, for a total of 130 MMscfd for the MFH Facility.

13.15.1.5 LNG vaporizers operating and design heat duties each (minimum, rated, maximum), million British Thermal Units per hour

The design heat duty of the LNG vaporizer on each package is 120,000 million British Thermal Units per hour, for a total of 240,000 million British Thermal Units per hour for the MFH Facility.

13.15.1.6 LNG vaporizers operating and design pressures (minimum, normal, maximum), psig

The LNG vaporizer design pressure for the MFH Facility is:

Shell Side: [redacted] / Tube Side: [redacted]

13.15.1.7 LNG vaporizers operating and design (minimum, normal, maximum), °F inlet temperatures

The LNG vaporizer inlet design temperature for the MFH Facility is:

Shell Side: [redacted] / Tube Side: [redacted]

13.15.1.8 LNG vaporizers operating and design (minimum, normal, maximum), °F outlet temperatures

The LNG vaporizer outlet design temperature for the MFH Facility is:

Shell Side: [redacted] / Tube Side: [redacted]

13.15.1.9 LNG vaporizers startup and operation

LNG vaporizer heating system

A gas-fired burner is the primary heating system for the LNG vaporizer.

LNG vaporization

LNG is vaporized in the gas-fired water bath vaporizer.

13.15.1.10 LNG vaporizers isolation valves, drains, and vents

This system is isolatable through a series of manual valves for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

Generated water handling/disposal system

The demin water is a closed-loop system flowing upstream of the water pumps for recycle through the LNG vaporizer. Inhibitor is injected based on the quality of the water supplying the water baths. Further information can be found on drawings in appendix 13E5.

13.15.1.11 LNG vaporizers BPCS

The LNG vaporizers are remotely operated through the plant DCS. Plant alarms shall alert operations to out of bound conditions set by the equipment manufacturer. Further information is found in appendices 13E5 and 13Q1.

13.15.1.12 LNG vaporizers SISs

In the event of an SIS-triggering event, the SIS system initiates shutdown valves to stop the vaporization operation as described in appendices 13E5 and 13Q1.

13.15.1.13 LNG vaporizers relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Thermal reliefs are included on piping where cryogens can be blocked in. Further information is provided in appendices 13R1 and 13R2.

13.15.1.14 LNG vaporizers other safety features

No other safety features for the LNG vaporizers have been identified.

13.16 HEAT TRANSFER FLUID SYSTEM(S)

This is not applicable for the MFH Facility.

13.17 British Thermal Unit ADJUSTMENT

This is not applicable for the MFH Facility.

13.18 SENDOUT METERING SYSTEM

13.18.1 Sendout Metering Design

[redacted]

13.18.1.1 Sendout operating and design flow rate capacities (minimum, normal, maximum), MMscfd

[redacted]

13.18.1.2 Sendout operating and design pressures (minimum, normal, maximum), psig

[redacted]

13.18.1.3 Sendout operating and design temperatures (minimum, normal, maximum), °F

[redacted]

13.18.1.4 Pipeline operating and design flow rate capacities (minimum, normal, maximum), MMscfd

This is not applicable for the MFH Facility.

13.18.1.5 Pipeline operating and design pressures (minimum, normal, maximum), psig

This is not applicable for the MFH Facility.

13.18.1.6 Pipeline operating and design temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.18.1.7 Sendout metering system startup and operation

Vaporized LNG exits the LNG vaporizer and flows through the metering skid to a tie-in point with the SJPP.

13.18.1.8 Sendout metering system isolation valves, drains, and vents

This system is isolatable through a series of manual valves for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

13.18.1.9 Sendout metering system BPCS

The LNG vaporizers are remotely operated through the plant DCS. Plant alarms shall alert operations to out of bound conditions set by the equipment manufacturer. Further information is found in appendices 13E5 and 13Q1.

13.18.1.10 Sendout metering system SISs

In the event of an SIS-triggering event, the SIS system initiates shutdown valves to stop the sendout/metering operation as described in appendices 13E5 and 13Q1.

13.18.1.11 Sendout metering system relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Thermal reliefs are included on piping where cryogens can be blocked in. Further information is provided in appendices 13R1 and 13R2.

13.18.1.12 Sendout metering system other safety features

No other safety features have been identified.

13.19 FUEL GAS

This is not applicable for the MFH Facility.

13.20 NITROGEN AND INERT GAS

13.20.1 Nitrogen Design

The MFH Facility is designed to store liquid nitrogen on-site and then vaporize the liquid nitrogen through an ambient vaporizer, also installed on-site. Further information on the nitrogen design can be found in appendices 13B1, 13E3, and 13E5.

13.20.1.1 Nitrogen source

Nitrogen is vaporized from an on-site storage drum and supplied for purge operations across the MFH Facility. The storage drum volumes are replenished by truck.

Number of liquid nitrogen trucks and truck capacity, gal

[redacted]

Nitrogen production system and production rate, gpm

This is not applicable for the MFH Facility.

13.20.1.2 Nitrogen distribution list of continuous and intermittent users or usage factors, including leakage, and usage requirement by equipment, standard cubic feet per minute

Nitrogen is distributed at the MFH Facility for purge operations on an intermittent, or infrequent, basis.

13.20.1.3 Number of liquid nitrogen storage tanks, operating and spare

There is one (1) liquid nitrogen storage tank at the MFH Facility.

13.20.1.4 Liquid nitrogen storage capacity, gal

[redacted]

13.20.1.5 Number of nitrogen vaporizers, operating and spare

There are two (2) nitrogen vaporizers at the MFH Facility, one (1) operating and one (1) spare.

13.20.1.6 Liquid nitrogen vaporizer type

The nitrogen vaporizers at the MFH Facility are an ambient type.

13.20.1.7 Number of nitrogen receivers, operating and spare

This is not applicable for the MFH Facility.

13.20.1.8 Liquid nitrogen vaporizer operating and design flow rate capacities, standard cubic feet per minute

[redacted]

13.20.1.9 Nitrogen receivers operating and design storage capacities, scf

This is not applicable for the MFH Facility.

13.20.1.10 Nitrogen receivers operating and design storage pressures (minimum, normal, maximum), psig

This is not applicable for the MFH Facility.

13.20.1.11 Nitrogen receivers residence times, minutes

This is not applicable for the MFH Facility.

13.20.1.12 Nitrogen system startup and operation

[redacted]

13.20.1.13 Nitrogen system shutdown

See section 13.20.1.16.

13.20.1.14 Liquid nitrogen truck loading

This is not applicable for the MFH Facility.

13.20.1.15 Nitrogen system isolation valves, drains, and vents

This system is isolatable through a series of manual valves and depressurization lines for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

13.20.1.16 Nitrogen system BPCS

The nitrogen system is remotely monitored through the plant DCS but operated locally. Plant alarms alert operations to out of bound conditions set by the equipment manufacturer or engineering contractor. Further information is found in appendices 13E5 and 13Q1.

13.20.1.17 Nitrogen system SISs

In the event of an SIS-triggering event, the SIS system initiates shutdown valves to stop the nitrogen operation as described in appendices 13E5 and 13Q1.

13.20.1.18 Nitrogen system relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Thermal reliefs are included on piping where cryogenic fluids can be blocked in. Further information is provided in appendices 13R1 and 13R2

13.20.1.19 Nitrogen system other safety features

No other safety features have been identified.

13.20.2 Inert Gas Design

This is not applicable for the MFH Facility.

13.21 INSTRUMENT AND PLANT/UTILITY AIR

13.21.1 Instrument Air Design

Compressed air is required for plant and instrument air. Compressors, dryers, and a receiver are required to ensure that dry air is supplied to all plant instruments and valve actuators. The air compressor package consists of two motor-driven main air compressors, a Utility Air Receiver, four instrument air dryers, and an Instrument Air Receiver.

Further information is contained in appendix 13B1 and appendix 13E5.

13.21.1.1 Instrument air distribution list of continuous and intermittent users or usage factors, including leakage, and usage requirement by equipment, scfm

The list of continuous and intermittent users is included in appendix 13M4.

13.21.1.2 Instrument air specifications, dew point, particulates

[redacted]

13.21.1.3 Number of filters, operating and spare

[redacted]

13.21.1.4 Instrument air compressors type

The air compressor package is an electrical, or motor, driven type.

13.21.1.5 Number of instrument air compressors, operating and spare

The air compressor package includes two 100% air compressors, both electrically driven.

13.21.1.6 Instrument air compressor operating and design flow rate capacities (minimum, normal/rated, maximum), scfm

[redacted]

13.21.1.7 Instrument air compressor operating and design discharge pressures (minimum, normal/rated, maximum), psig

Operating Pressure	**100 psig**
Operating Pressure (Min)	[redacted]
Design Pressure	[redacted]

13.21.1.8 Instrument air drying system type

[redacted]

13.21.1.9 Number of instrument air dryers, operating and spare

[redacted]

13.21.1.10 Instrument air dryers operating and design dew point temperatures, °F

[redacted]

13.21.1.11 Number of air receivers, operating and spare

[redacted]

13.21.1.12 Air receiver operating and design storage capacities, scf

[redacted]

13.21.1.13 Instrument air receiver operating and design storage pressures (minimum, normal, maximum), psig

[redacted]

13.21.1.14 Air receiver residence times, sec

[redacted]

13.21.1.15 Instrument air startup and operation

[redacted]

13.21.1.16 Instrument air isolation valves, drains, and vents

This system is isolatable through a series of manual valves and depressurization lines for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

13.21.1.17 Instrument air BPCS

The air compressor package is locally operated and monitored through a human machine interface ("HMI") on the package. Further information is found in appendices 13E5 and 13Q1.

13.21.1.18 Instrument air SISs

In the event of an SIS-triggering event, the SIS system initiates shutdown valves to isolate the operation as described in appendices 13E5 and 13N1.

13.21.1.19 Instrument air relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Further information is provided in appendices 13R1 and 13R2.

13.21.1.20 Instrument air other safety features

No other safety features have been identified.

13.21.2 Plant/Utility Air Design

A portion of instrument air will be used for plant air functions. There is no separate plant air.

13.21.2.1 Plant/utility air compressors type

See section 13.21.1.4.

13.21.2.2 Number of plant/utility air compressors, operating and spare

See section 13.21.1.5.

13.21.2.3 Plant/utility air distribution list of continuous and intermittent users or usage factors, including leakage, and usage requirement by equipment, scfm

[redacted]

13.21.2.4 Plant/utility air specifications

See section 13.21.1.2.

13.21.2.5 Plant/utility air compressors operating and design flow rate capacities (minimum, normal/rated, maximum), scfm

See section 13.21.1.6.

13.21.2.6 Plant/utility air compressors operating and design discharge pressures (minimum, normal/rated, maximum), psig

See section 13.21.1.7.

13.21.2.7 Number of plant/utility air receivers, operating and spare

There is one Utility Air Receiver at the MFH Facility.

13.21.2.8 Plant/utility air receivers operating and design storage capacities, scf

[redacted]

13.21.2.9 Plant/utility air receivers operating and design storage pressures (minimum, normal, maximum), psig

[redacted]

13.21.2.10 Plant/utility air receivers operating and design residence times, minutes

[redacted]

13.21.2.11 Plant/utility air startup and operation

See section 13.21.1.15.

13.21.2.12 Plant/utility air isolation valves, drains, and vents

This system is isolatable through a series of manual valves and depressurization lines for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

13.21.2.13 Plant/utility air BPCS

The air compressor package is locally operated and monitored through an HMI on the package. Further information is found in appendices 13E5 and 13Q1.

13.21.2.14 Plant/utility air SISs

This is not applicable for the MFH Facility.

13.21.2.15 Plant/utility air relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Further information is provided in appendices 13R1 and 13R2.

13.21.2.16 Plant/utility air other safety features

No other safety features have been identified.

13.22 UTILITY WATER AND OTHER UTILITIES

13.22.1 Utility Water Design

Demineralized water is brought to the MFH Facility in trucks, unloaded and stored in the Demin Water Makeup Tank. The demin water is injected with inhibitor based upon the water quality of the water supplying the water baths.

13.22.1.1 Utility water type (service water, potable water, demineralized water, steam, chemical treatment. scavengers)

The utility water type at the MFH Facility is demineralized water.

13.22.1.2 Utility water sources

Trucks supply the MFH Facility demineralized water demands.

13.22.1.3 Utility water distribution list and usage requirement by equipment, gpm

The demineralized water system is considered a closed-loop system servicing the gas-fired water bath vaporizers in each of the LNG vaporizer packages.

13.22.1.4 Utility water operating and design storage capacities (minimum, normal, maximum), gal

[redacted]

13.22.1.5 Utility water operating and design flow rate capacities (minimum, normal, maximum), gpm

[redacted]

13.22.1.6 Utility water operating and design pressures (minimum, normal, maximum), psig

[redacted]

13.22.1.7 Utility water startup and operation

The demineralized water system is a closed-loop systems, however, inhibitor is injected based upon the quality of the water supplying the water baths. Demin water is the circulated through the water bath vaporizers.

13.22.1.8 Utility water isolation valves, drains, and vents

This system is isolatable through a series of manual valves and depressurization lines for maintenance activities. Further information on isolation, vents and drains can be found on drawings in appendix 13E5.

13.22.1.9 Utility water BPCS

The system is remotely operated through the plant DCS. Plant alarms shall alert operations to out of bound conditions set by the equipment manufacturer or design.

13.22.1.10 Utility water SISs

In the event of an SIS-triggering event, the SIS system initiates shutdown valves to isolate the operation as described in appendices 13E5 and 13N1.

13.22.1.11 Utility water relief valves and discharge

Relief valves are sized according to the governing scenario for each piece of equipment. Further information is provided in appendices 13R1 and 13R2.

13.22.1.12 Utility water other safety features

No other safety features have been identified.

13.22.2 Other Utilities Design

This is not applicable for the MFH Facility.

13.23 PIPING AND VALVES

13.23.1 Piping and Valve Design

Piping systems for the MFH Facility are described below. The use of flanges in cryogenic piping is minimized, except where entry or disassembly for inspection or maintenance after startup are anticipated or required, such as for heat exchangers or relief valves.

Equipment and piping systems at the MFH Facility are a combination of shop-fabricated modules and field fabricated facilities. These equipment and piping systems have been arranged to achieve the most efficient process flow, specifically arrangements that provide maintenance and operation access along with any required platforms. Process-related piping systems are designed in accordance with the Piping Specifications included in appendix 13F2.

13.23.1.1 Piping and valve list(s)

Piping and valves are shown on the piping and instrumentation ("P&ID") designs included in appendix 13E5. A piping and valve list is included in appendix 13M1.

13.23.1.2 Tie-in list(s)

No tie-ins are present.

13.23.1.3 Isolation, vent and drain philosophies

Isolation, vent and drain configurations are shown on the P&IDs in appendix 13E5.

13.23.1.4 Car seal and lock philosophy

Car seals and lock-out tag-out configurations are shown on the P&IDs in appendix 13E5.

13.23.1.5 Piping layout

The locations of major pipe racks at the MFH Facility are shown in the general arrangement drawing included in appendix 13A1. See section 13.23.1.6 for additional detail on the general piperack layouts.

13.23.1.6 Pipe supports and pipe racks

This information is detailed in appendix 13J7.

13.23.1.7 Piping, valve, flange, and insulation design and specifications

The Piping Specifications included in appendix 13F defines the acceptable piping components and minimum requirements for piping materials, for all piping classes.

Piping is insulated where necessary to conserve energy, maintain process stability, reduce noise (acoustic insulation), protect personnel and/or prevent moisture condensation and freezing. Insulation thickness is based upon design parameters relevant to site conditions, including cold or hot service, ambient temperature, relative humidity, wind velocity and maximum heat gain/loss.

Conditions and loads (e.g. pressures, temperatures, vibration, internal and external corrosion, etc.)

The Piping Specifications included in appendix 13F defines the acceptable loads for piping.

Material of construction temperature limits

The Piping Specifications included in appendix 13F defines the acceptable piping temperature limits.

Material of construction allowable stress limits

The Piping Specifications included in appendix 13F defines the acceptable piping stress limits.

Material of construction corrosivity potential and corrosion allowance

The Piping Specifications included in appendix 13F define the acceptable corrosion allowances.

Cathodic protection

Cathodic protection for the MFH Facility is limited to the protection of the piling structures supporting the marine berth.

*13.23.1.8 Positive Material Identification Requirements**

The Piping Specifications included in appendix 13F define the necessary identification requirements.

*13.23.1.9 Post Weld Heat Treatment**

The Piping Specifications included in appendix 13F define the necessary treatment requirements.

*13.23.1.10 Non-destructive examination**

Weld radiographic/ultrasonic testing

The Piping Specifications included in appendix 13F define the necessary testing requirements.

Magnetic particle or liquid penetrant examination

The Piping Specifications included in appendix 13F define the necessary testing requirements.

Pneumatic/hydrostatic leak testing medium and pressure

The Piping Specifications included in appendix 13F define the necessary testing requirements.

Other

This is not applicable for the MFH Facility.

*13.23.1.11 Piping and valve preventative maintenance**

The MFH Facility utilizes eMaint, a computerized maintenance management system ("CMMS") software, to manage and schedule preventative maintenance activities for all of the process and utility systems in the MFH Facility.

13.24 PROCESS VESSELS

13.24.1 Process Vessel Design

The process vessels for the MFH Facility have been designed in accordance with applicable codes and standards to meet the design conditions and desired operational throughput. Further information on the design conditions and desired operational throughput is contained in appendix 13B1, process vessel specifications are contained in appendix 13F2, and data sheets are contained in appendix 13M4.

13.24.1.1 Process Vessel List

The equipment list for the MFH Facility is included in appendix 13M3.

13.24.1.2 Process vessel layout

Information on the process vessel layout is contained in appendix 13A1.

13.24.1.3 Process vessel support

Process vessels at the MFH Facility are affixed on a combination of slab-on-grade foundation and deep foundations (piles).

13.24.1.4 Process vessel and insulation design and specifications

Specifications for the design of the process vessels and insulation are contained in appendix 13F.

Conditions and loads (e.g. pressures, temperatures, vibration, internal and external corrosion, etc.)

Specifications for the design of the process vessels and insulation are contained in appendix 13F.

Material of construction allowable stress limits

Specifications for the design of the process vessels and insulation are contained in appendix 13F.

Material of construction temperature limits

Specifications for the design of the process vessels and insulation are contained in appendix 13F.

Material of construction corrosivity potential and corrosion allowance

Specifications for the design of the process vessels and insulation are contained in appendix 13F.

Cathodic protection

Cathodic protection is not required for the process vessels at the MFH Facility.

13.24.1.5 Non-destructive examination

Process vessel testing was performed in accordance with all applicable codes.

Magnetic particle or liquid penetrant examination

Magnetic particle and liquid penetrant examination procedures, and their results, are contained in appendix 13M.

Full or spot radiographic or ultrasonic testing

Full or spot radiographic or ultrasonic testing procedures, and their results, are contained in appendix 13M.

Pneumatic or hydrostatic leak testing pressure

Pneumatic or hydrostatic leak testing procedures and results are contained in appendix 13M.

13.24.1.6 Process vessel preventative maintenance

The MFH Facility utilizes eMaint, a CMMS software, to manage and schedule preventative maintenance activities for all of the process and utility systems in the MFH Facility.

13.25 ROTATING EQUIPMENT

13.25.1 Rotating Equipment Design

The rotating equipment for the MFH Facility have been designed in accordance with applicable codes and standards to meet the design conditions and desired operational throughput. Further information on the design conditions and desired operational throughput is contained in appendix 13B1 and data sheets are contained in appendix 13M4.

13.25.1.1 Rotating equipment and drivers list

The equipment list for the MFH Facility is included in appendix 13M3.

13.25.1.2 Rotating equipment layout

Information on the rotating equipment layout is contained in appendix 13E6.

13.25.1.3 Rotating equipment support

Rotating equipment at the MFH Facility is supported on a combination of slab-on-grade foundation and deep foundations (piles).

13.25.1.4 Rotating equipment design and specifications

Conditions and loads (e.g. pressures, temperatures, vibration, internal and external corrosion, etc.)

Specifications for the design of the rotating equipment are contained in appendix 13F.

Performance curves

Pump curves for the high pressure pump skid are provided in appendix 13M4.

Material of construction allowable stress limits

Materials of construction are provided in appendix 13M4.

Material of construction temperature limits

Materials of construction are provided in appendix 13M4.

Material of construction corrosivity potential and corrosion allowance

Materials of construction are provided in appendix 13M4.

Cathodic protection

This is not applicable for the MFH Facility.

13.25.1.5 Machinery Monitoring System

This is not applicable for the MFH Facility.

13.25.1.6 Rotating equipment preventative maintenance

The MFH Facility utilizes eMaint, a CMMS software, to manage and schedule preventative maintenance activities for all of the process and utility systems in the MFH Facility.

13.26 FIRED EQUIPMENT

13.26.1 Fired Equipment Design

The fired equipment for the MFH Facility has been designed in accordance with applicable codes and standards to meet the design conditions and desired operational throughput. Further information on the design conditions and desired operational throughput is contained in appendix 13B1 and the data sheets are contained in appendix 13M4.

13.26.1.1 Fired equipment list

The equipment list for the MFH Facility is included in appendix 13M3.

13.26.1.2 Fired equipment layout

Information on the fired equipment layout is contained in appendix 13E6.

13.26.1.3 Fired equipment support

Fired equipment at the MFH Facility is supported on a combination of slab-on-grade foundation and deep foundations (piles).

13.26.1.4 Fired equipment design and specifications

Conditions and loads (e.g. pressures, temperatures, vibration, internal and external corrosion, etc.)

Design details of the gas fired water bath vaporizers are contained in appendix 13M5.

Duty

Design details of the gas fired water bath vaporizers are contained in appendix 13M5.

Material of construction allowable stress limits

Design details of the gas fired water bath vaporizers are contained in appendix 13M5.

Material of construction temperature limits

Design details of the gas fired water bath vaporizers are contained in appendix 13M5.

Material of construction corrosivity potential and corrosion allowance

Design details of the gas fired water bath vaporizers are contained in appendix 13M5.

Cathodic protection

Cathodic protection for the MFH Facility is limited to the protection of the piling structures supporting the marine berth.

13.26.1.5 Burner Management System

This is not applicable for the MFH Facility.

13.26.1.6 Fired equipment preventative maintenance

The MFH Facility utilizes eMaint, a CMMS software, to manage and schedule preventative maintenance activities for all of the process and utility systems in the MFH Facility.

13.27 BUILDINGS AND STRUCTURES

13.27.1 Buildings and Structures Design

Construction was performed in accordance with code requirements consistent with the function of each building and structure, though in general, buildings are constructed as slab-on-grade concrete. Further information on the buildings and structures design is contained in appendix 13B1.

13.27.1.1 Buildings list with dimensions and purpose

The following buildings are at the MFH Facility:

- A two-story Operations Building measuring 81 feet by 36 feet whose purpose is control and administration of the MFH Facility;
- A single-story electrical building measuring 63 feet-4 inches by 28 feet-7 inches whose purpose is the supply of power to the MFH Facility; and,
- A security guard house measuring 17 feet-6 inches by 7 feet-7 inches, which is comprised of a preexisting guardhouse measuring 9 feet-3 inches by 7 feet-7 inches and an attached new restroom measuring 8 feet-3 inches by 7 feet-7 inches.

13.27.1.2 Building and structure design and specifications

Further information on the buildings and structures design is contained in appendices 13B1 and appendix 13M8.

13.27.1.3 Building layout and siting

The Building Drawings, which provide the plans and elevations of the Operations Building and the electrical building, are contained in appendix 13M8.

13.28 ELECTRICAL

13.28.1 Electrical System Design

The MFH Facility electrical system, equipment, and installation was designed in accordance with the applicable national codes, local codes and regulations and federal regulations. The system is designed to maximize reliability and safety, while considering operational costs and ease of maintenance.

Power to the MFH Facility is provided by PREPA via a utility stepdown transformer from 38 kilovolts ("kV") to 4160V. 4160V is then routed from the substation location, adjacent to site entrance, to supply power at 4160V, 3-phase, 60 hertz. Further information is contained in appendices 13B1 and 13N3.

13.28.1.1 Power requirements

The total calculated maximum load demand for normal operation is 2711 kilovolt-amperes ("kVA"). Further information is contained in appendix 13N1.

13.28.1.2 Main power supply, utility/generated

Power to the MFH Facility is provided by PREPA via a utility stepdown transformer from [redacted] 4160V is then routed from the substation location, adjacent to site entrance, to a 4160V switchgear [redacted] The switchboard is rated at 5000A per trans-loading facility requirements. [redacted]

*13.28.1.3 Electrical Equipment layout drawings**

Drawings for the electrical building are contained in appendix 13M8.

*13.28.1.4 Cable routing drawings**

Electrical details are contained in appendix 13N8.

13.28.1.5 Main power generators, type

This is not applicable for the MFH Facility.

13.28.1.6 Number of main power generators, including any black start generators

This is not applicable for the MFH Facility.

13.28.1.7 Main power supply voltage, kV

4.16 kV, 3-phase, 60Hz. Further information is contained in appendix 13N1.

13.28.1.8 Main power supply capacity, kVA

The main power supply capacity for normal operation is 2711 kVA. Further information is contained in appendix 13N1.

13.28.1.9 Emergency power supply, utility/generated

Standby emergency power is provided as follows:

- [redacted]

[redacted]

- [redacted]
- [redacted]

13.28.1.10 Emergency power generators, type

[redacted]

13.28.1.11 Number of emergency power generators, No.

A total of two emergency generators are installed.

13.28.1.12 Emergency power voltage, kV

[redacted]

13.28.1.13 Emergency power capacity, kVA

[redacted]

13.28.1.14 Uninterruptable Power Supply services, voltage, size and capacity, V, kVA, hr

[redacted]

13.28.1.15 Transformer type, dry/oil

[redacted]

- [redacted]
- [redacted]
- [redacted]

Further information about the transformer is contained in appendix 13F3.

13.28.1.16 Number of transformers

There is one transformer located in the MFH Facility.

13.28.1.17 Electrical distribution system

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

Further information about the electrical distribution system is contained in appendix 13F3.

13.28.1.18 Distribution and voltage levels

Power is received at 4160V at the substation adjacent to the MFH Facility entrance. The main power distribution to the MFH Facility is at 4160V. [redacted]

[redacted]

Further details are contained in appendices 13F3 and 13N3.

13.28.1.19 UPS, battery backup system

Refer to section 13.28.1.14.

*13.28.1.20 Electrical cable schedule/list**

The cable schedule is contained in appendix 13N8.

13.28.1.21 Electrical cable design and specification

The electrical cable design and vendor supplied data for the MFH Facility are contained in appendix 13N7.

13.28.1.22 Cathodic protection

Cathodic protection for the MFH Facility is limited to the protection of the piling structures supporting the marine berth.

13.28.1.23 Hazardous area classifications

The Hazardous Classification of plant areas is shown on Hazardous Area Classification drawings for the purpose of aiding in the selection of electrical components on process equipment, electrical equipment, and wiring methods. Further information is contained in in appendix 13N5.

13.28.1.24 Ignition control setbacks and separation

Separation distances for ignition sources are in accordance with NFPA 59A – 2006 edition. The MFH Facility is designed in accordance with NFPA 59A 2016 edition. The fire protection and hazard detection design are in accordance with NFPA 59A 2006 edition due to the incorporation by reference in the Puerto Rico Building Code.

13.28.1.25 Electrical pass-through seals and vents to the atmosphere

Connections on the pressure boundary to electrical leads and instrumentation cable conduits are sealed to prevent the passage of LNG vapors through the associated seal into the conduit or cable core.

The connections include a dual seal between the flammable fluid and the electrical system.

Further information on the electrical pass-through seals is contained in appendix 13N6.

13.29 PLANS AND PROCEDURES

13.29.1 Operation and Maintenance Plans

The MFH Facility is operated and maintained in accordance with the plans and procedures as detailed below. This includes day-to-day operations and maintenance activities, unloading and marine berth operations, security plans and periodic training.

13.29.1.1 Operation procedure development

Procedures for the operation of the MFH Facility are contained in appendix 13O4.

13.29.1.2 Safety procedures (e.g., hot work and other work permit procedures, etc.)

Procedures for the safety of the MFH Facility are contained in appendix 13O6.

13.29.1.3 Maintenance plan and procedure development

Procedures for the maintenance of the MFH Facility are contained in appendix 13O5.

13.29.1.4 Operations and maintenance structure

A copy of the organization chart for the operations of the MFH Facility can be found in appendix 13A4.

*13.29.1.5 Number of operation and maintenance personnel**

The operations and maintenance of the MFH Facility employs approximately 21 personnel.

*13.29.1.6 Location of operation and maintenance personnel**

The operations and maintenance personnel for the MFH Facility are in the San Juan, Puerto Rico metropolitan area.

*13.29.1.7 Operation and maintenance personnel training**

The operations and maintenance personnel for the MFH Facility receive specific job training, as well as periodic training. These trainings include specific operations and maintenance procedures for VFDs, PLCs, Pneumatic Equipment, Instrumentation and Controls, Sensors, eMaint (CMMS), as well as the continuity training for licensed electricians.

*13.29.1.8 Training plans and procedures**

Procedures for the training of personnel for the operation of the MFH Facility are contained in appendix 13O4.

*13.29.1.9 Management procedures (e.g., alarm management, shift procedures/fatigue management, management of change procedures, etc.)**

Procedures for the management of the MFH Facility are contained in appendices 13O1 and 13O4.

13.30 INSTRUMENTATION AND CONTROLS

13.30.1 BPCS

The MFH Facility Integrated Control and Safety System ("ICSS") provides the capability for operations to be managed from the control room located in the Operations Building. The ICSS monitors and controls the LNG unloading, vaporization, and truck loading processes during startup, shutdown, normal operation, abnormal operation or process upsets, and emergency shutdown conditions.

The ICSS facilitates:

- Sufficient online event monitoring and control capabilities to ensure continuous, safe, reliable and efficient operation;
- Alerting operators in a timely manner of any abnormal conditions requiring manual intervention;
- Bringing the plant or equipment to a safe state for any abnormal conditions; and,

- Tools to support Maintenance and Engineering activities.

The ICSS for the MFH Facility conforms to the standards and requirements listed in the Plant Control and Safety System Specification contained in appendix 13F3.

13.30.1.1 Instrument list

The instrument list for the MFH Facility is contained in appendix 13P1, whereas the instruments are depicted on the P&IDs and contained in appendix 13E5.

13.30.1.2 Instrumentation design and specifications

The MFH Facility instrumentation design and specifications conform to the standards and design documents outlined in Basis of Design, contained in appendix 13B1.

13.30.1.3 BPCS philosophy

The control system consists of field instrumentation and several microprocessor-based sub-systems throughout the MFH Facility. The ICSS for the MFH Facility utilizes commercially available and proven hardware and software that has passed technical evaluation by NFEnergía, Incentrik, Black & Veatch, and Moffat & Nichol. Primary operator interfaces and controls are located in the control room, which is located in the Operations Building. The PCS provides the MFH Facility personnel with user-friendly information displays for monitoring, processing, and automatic and manual control of the processes.

13.30.1.4 BPCS architecture

ICSS Block and Network Architecture diagrams are contained in appendix 13P2.

13.30.1.5 BPCS design and specifications

The MFH Facility instrumentation design and specifications conform to the standards and design documents outlined in Basis of Design in appendix 13B1.

13.30.1.6 Number of servers, operating and backup

The MFH Facility has a redundant pair of servers, primary and secondary.

13.30.1.7 Number of historians, operating and backup

There is one historian running on the primary server.

13.30.1.8 Distributed control systems block diagrams

The DCS block diagram is included in appendix 13P2.

13.30.1.9 PLC and DCS software

[redacted]

13.30.1.10 Control communication types

The control communication types for the MFH Facility conform to the Plant Control and Safety System specification contained in appendix 13F3.

13.30.1.11 Number of lines of communication to control room, operating and backup

The number of lines of communication to the control room is displayed on the network architecture diagram contained in appendix 13P2.

13.30.1.12 Control power sources, operating and backup

Cabinets are fed from separate, protected, redundant pairs of power feeders, one of which is the UPS. Further information is contained in appendices 13F3 and 13N3.

13.30.1.13 HMI local and control room displays, type

HMIs are located in the control room and at the truck loading bays. The HMI display types for the MFH Facility conform to the specification contained in appendix 13F3.

13.30.1.14 Number of HMI control room displays

There are two HMI control room displays: one quad screen operator workstation, and one quad screen engineering workstation.

13.31 SAFETY INSTRUMENTED SYSTEMS

13.31.1 SIS Design

The SIS is independent and segregated from the PCS but interfaced to it through redundant data links that allow the operator to monitor SIS data from the control room using the same HMI. The SIS serves to protect personnel, environment, and equipment from abnormal and hazardous conditions without operator intervention, by activating defined safety instrument functions when the PCS is not capable of maintaining the plant within its defined normal and safe operating envelope. The SIS implements safety instrument functions for PSD, ESD, and fire and gas detection systems ("FGS"). It provides detection, logic sequencing, and actuation of devices to place the system or facility in a safe state.

[redacted]

[redacted]

[redacted]

[redacted]

Further information is contained in appendix 13F3.

13.31.1.1 SIS, FGS, ESD and depressurization philosophies

The SIS has completely independent hardware, wiring systems, and field instrumentation. The components of the SIS consist of sensors, logic solvers, and final control elements. Safety interlocks have been implemented in protective systems supplied by the manufacturer. Interfaces between the manufacturer's packaged system and the SIS provide protection for external upset conditions that require shutdown of the mechanical equipment..

13.31.1.2 SIS and FGS architecture

The MFH Facility SIS and FGS architecture drawings are contained in appendix 13P2.

13.31.1.3 SIS, FGS, and ESD cause and effect matrices

The MFH Facility cause and effect matrices are contained in appendix 13Q1.

13.31.1.4 SIS, FGS, and ESD design and specifications

The MFH Facility SIS, FGS and ESD design and specifications conform to the standards and design documents outlined in Basis of Design in appendix 13B1.

*13.31.1.5 Number of SIS and FGS servers, operating and backup**

The servers for the SIS and FGS are the same as the BPCS Design.

*13.31.1.6 Number of SIS and FGS historians, operating and backup**

The servers for the SIS and FGS are the same as the BPCS.

13.31.1.7 SIS and FGS block diagrams

The MFH Facility SIS and FGS architecture drawings are contained in appendices 13P2 and 13S6.

*13.31.1.8 SIS and FGS software**

The BPCS, SIS, and FGS software is the Rockwell Logix Designer.

13.31.1.9 List of ESD valves

A list of the ESD valves is contained in appendix 13Q3.

*13.31.1.10 ESD valve spacing**

ESD valve locations are indicated on the process and instrumentation diagrams included in appendix 13E5.

*13.31.1.11 ESD closure times**

[redacted]

*13.31.1.12 SIS, FGS, and ESD Safety Integrity Levels**

The MFH Facility has a SIL rating of SIL-2.

13.32 SECURITY PLANS

13.32.1 Physical Security Plans

13.32.1.1 Security plan developments

[redacted]

In compliance with 33 CFR § 127.305, the MFH Facility has developed an Operations Manual which describes the security systems as well as the procedures for handling violations of those security systems.

The Facility Security Plan was approved by USCG and a copy of the letter is provided in appendix 13G8.

13.32.1.2 Lighting

Outdoor lighting is provided by 35' light-emitting diode ("LED") Light Poles with luminaires, 480Vt, 1 phase, 60 Hz. Additional lighting is provided by pipe rack flood lighting or stanchion-mounted, LED area luminaires controlled by time clock/photocell. Luminaires are approximately 24' high above finished grade. Lighting luminaires installed in classified areas are rated for the classification type at the location of the installation, in accordance with NFPA 70. Lighting controlled by a centralized time clock/photocell includes contactors and hand-off-auto selector switches. All suspended fixtures are permanently fastened to structural members.

- Per 29 CFR §1917.123 the minimum foot candle requirements for the general operating and process areas is 5 candle feet.

These lighting levels are supplemented in certain areas in order to meet the Illumination Engineers Society specific task recommendations.

Lighting fixtures were selected for the various lighting tasks as follows:

- Terminal Lighting: 35' LED Site Lighting Poles
- Process Piping & LNG Pump Skid Areas: LED Stanchion or Flood Lighting
- Electrical rooms, etc.: LED Lighting
- Control rooms and offices: LED Lighting
- Outdoor operations areas: LED Stanchion or Floodlights

In addition to the normal lighting, battery powered and/or UPS supported lighting are provided to give immediate light following a power failure for building egress requirements and personnel safety, especially in the following areas: stairways, exits and around all equipment where personnel would otherwise be endangered in the event of a power failure.

Lighting drawings are provided in appendix 13G8.

13.32.1.3 Physical barriers (e.g., fences, vehicle barriers, etc.)

[redacted]

Barriers and bollards are installed to protect existing wharf, equipment, and buildings from vehicles as indicated on the project drawings.

Fence details are provided in appendix 13G8.

13.32.1.4 Site and on-site access controls

[redacted] Site security measures include barbed wire fencing, security gates, personnel security and main entrance gate arms located at the Guardhouse entrance.

The Ops Building contains a complete CCTV system for additional security and monitoring. Ops Building doors and control room doors utilize fingerprint readers for controlled access.

13.32.1.5 Intrusion monitoring

[redacted]

13.32.1.6 Intrusion detection

[redacted]

13.32.1.7 Site security communication

The MFH Facility utilizes communication systems and procedures to provide effective and continuous communications between all personnel; LNG FSUs and shuttle vessels interfacing with the marine transfer area; the Captain of the Port; and federal, state, and local authorities with security responsibilities.

13.32.1.8 Site security service and number of site security personnel

[redacted]

13.32.1.9 Site security use of force

All security personnel are professionally trained in access and egress management, life and property protection and patrolling techniques.

13.32.1.10 Site security training

The MFH Facility Security Plan details the requirements for site security training, which includes security drills every 3 months, training exercises on an annual basis, and International Ship and Port Security training for those identified personnel.

13.32.1.11 Setbacks, blast walls, hardened structures, and blast resistant designs

The LNG truck loading bays are located approximately 300 feet from the main entrance gate, with all other equipment and buildings for the MFH Facility are located beyond this.

13.32.2 Cybersecurity Plans

NFEnergía implements a suite of cybersecurity technical controls for the MFH Facility.

13.32.2.1 Cybersecurity Plan developments

The MFH Facility is currently completing an assessment of the cybersecurity risks, as well as internal network penetration tests and a security audit of all control systems. Once complete, the MFH Facility will then work to remediate the identified risks and potential security issues, as well as updating the response plans and training programs.

13.32.2.2 Physical access to control systems

All employees undergo a background check. Physical access to control systems, including cyber asset control system network components, is restricted and provided only on an as-needed basis with approval.

13.32.2.3 Computer and network access controls

[redacted]

[redacted]

[redacted]

13.32.2.4 Intrusion monitoring

[redacted]

13.32.2.5 Intrusion detection

[redacted]

13.32.2.6 Cybersecurity personnel and response teams

See section 13.32.2.5.

13.32.2.7 Cybersecurity awareness and training

The MFH Facility is currently updating their cybersecurity training, as well as creating a disaster recovery plan.

13.32.2.8 Air gaps, waterfalls, and firewalls

See section 13.32.2.4.

13.33 RELIEF VALVE AND FLARE/VENT SYSTEMS

13.33.1 Relief Valves and Flare/Vent Systems Design

The MFH Facility includes several pressure relieving valves, as well as thermal relieving valves to ensure the safe, continuous operation of the MFH Facility. The relief valves are sized in accordance with industry codes and standards and are contained appendix 13R1. The relief valves connect to the flare header, as outlined on the P&IDs contained in the appendix 13E5. The MFH Facility includes an enclosed ground flare referred to as the gas combustion unit ("GCU"). The flare is designed to safely combust methane without a visible flame.

13.33.1.1 List of relief valves

The list of relief valves is contained in appendix 13R1.

13.33.1.2 Relief valve philosophy

The relief valve philosophy is contained in appendix 13B1.

13.33.1.3 Relief valve studies

Relief valve sizing calculations are included in appendix 13R1.

13.33.1.4 Vent stack philosophy

This is not applicable for the MFH Facility.

13.33.1.5 Vent stack type

This is not applicable for the MFH Facility.

13.33.1.6 Number of vent stacks

This is not applicable for the MFH Facility.

13.33.1.7 Vent stack height and diameter

This is not applicable for the MFH Facility.

13.33.1.8 Vent stack studies

This is not applicable for the MFH Facility.

13.33.1.9 Vent sources

This is not applicable for the MFH Facility.

13.33.1.10 Vent stack operating and design flow rate capacities (minimum, normal/rated, maximum), MMscfd

This is not applicable for the MFH Facility.

13.33.1.11 Vent stack operating and design pressures (minimum, normal/rated, maximum), psig

This is not applicable for the MFH Facility.

13.33.1.12 Vent stack operating and design temperatures (minimum, normal, maximum), °F

This is not applicable for the MFH Facility.

13.33.1.13 Vent stack operating and design densities (minimum, normal, maximum), specific gravity

This is not applicable for the MFH Facility.

13.33.1.14 Flare philosophy

The GCU is designed to combust the vapor from the vapor collection header. [redacted]

[redacted]

The following design factors were considered: available pressure, waste gas composition, waste gas temperature, waste gas flow rate, ambient temperature, marine environment, and pilot fuel source. This list is not exhaustive.

13.33.1.15 Flare type

The GCU is a totally enclosed ground flare.

13.33.1.16 Number of flares

There is one GCU at the MFH Facility.

13.33.1.17 Flare height and diameter

The GCU is 45 feet in height and 11 feet in diameter.

13.33.1.18 Flare studies

See the enclosed ground flare specification included in appendix 13R2.

13.33.1.19 Flare sources

Vapor return from the vapor header.

13.33.1.20 Flare operating and design flow rate capacities (minimum, normal/rated, maximum), MMscfd

	Minimum Relieving Case at Stack /Flare Inlet (MMscfd)	Normal Relieving Case at Stack /Flare Inlet (MMscfd)	Maximum Relieving Case at Stack /Flare Inlet (MMscfd)
GCU	[redacted]	[redacted]	[redacted]

13.33.1.21 Flare operating and design pressures (minimum, normal/rated, maximum), psig

	Minimum Relieving Case Pressure at Stack /Flare Inlet (psig)	Normal Relieving Case Pressure at Stack /Flare Inlet (psig)	Maximum Relieving Case Pressure at Stack /Flare Inlet (psig)
GCU	[redacted]	[redacted]	[redacted]

13.33.1.22 Flare operating and design temperatures (minimum, normal, maximum), °F

	Minimum Relieving Case Temperature at Stack /Flare Inlet (F)	Normal Relieving Case Temperature at Stack /Flare Inlet (F)	Maximum Relieving Case Temperature at Stack /Flare Inlet (F)
GCU	[redacted]	[redacted]	[redacted]

13.33.1.23 Flare operating and design densities (minimum, normal, maximum), specific gravity

The operating and design densities are not explicitly defined for the MFH Facility.

13.33.1.24 Flare operating and design radiant heat (maximum), British Thermal Unit per square foot per hour

This is not applicable at the MFH Facility, as there is no ground level exposure to thermal radiation from the enclosed flare.

13.33.1.25 Flare operating and design decibel (maximum), decibels on the A-weighted scale

The noise from the GCU has a maximum of 88 dBA and design of 86 dBA at zero (0) feet from the source, with dBA values decreasing with distance from the source.

13.34 SPILL CONTAINMENT

13.34.1 Spill Containment System Design

The MFH Facility complies with applicable provisions in Chapter 13 of NFPA 59A-2006/2016 for spill containment systems, which are summarized below. The MFH Facility is designed in accordance with NFPA 59A 2016 edition. The fire protection and hazard detection design are in accordance with NFPA 59A 2006 edition due to the incorporation by reference in the Puerto Rico Building Code.

The spill containment system for plant equipment and piping was sized to contain the largest volume of the largest container. The trenches and the impoundment sump were built with concrete.

Further information is contained in appendix 13S and 13H3.

13.34.1.1 Spill containment philosophy

The LNG impoundment basin was sized to hold more than 100 percent of the liquid capacity of the largest vessel, in accordance with the requirements of NFPA 59A 2006/2016 editions. Since the MFH Facility does not include an LNG storage tank, the 100% capacity requirement was applied to the LNG suction drums. The largest suction drum has a maximum liquid capacity of 33,000 US gal.

13.34.1.2 Spill locations and flows

This is not applicable for the MFH Facility.

13.34.1.3 Impoundment volumetric capacities

The LNG impoundment basin is sized for more than 100 percent of the greatest vessel volume (33,000 US gal). Table 13-10 provides the dimensions of the impoundment basin.

Table 13-10: Impoundment Basin Dimensions.

Side Length	Side Width	Depth	Total Capacity
30 feet	[redacted]	[redacted]	[redacted]

13.34.1.4 Trench and trough volumetric flow capacities

[redacted]

13.34.1.5 Downcomer volumetric flow capacities

This is not applicable for the MFH Facility.

13.34.1.6 Impoundment system water removal

A pump is provided to remove stormwater from the spill containment system and outfall to existing storm drain system via a pipe. Pumping will cease immediately if a spill occurs and will not resume until the system has been sufficiently cleaned to prevent downstream adverse impacts.

13.34.1.7 Storm water flow design basis

The necessary flow capacity of the impoundment pump was determined based on the requirements stated in NFPA 59A-2016 section 5.2.2.10.2 that “the water removal system [for the impoundment area] shall have the capacity to remove water at a minimum of 25% of the rate from a storm of a 10-yr frequency and a 1-hour duration."

A single pump is used to remove rainfall from the impoundment; a second redundant pump is provided as backup. The pump is explosion proof and designed to be durable in a corrosive environment. A single, simplex controller is specified to operate the pump using float switches that will operate the pump based on the water elevations in the impoundment. A 2.5 feet deep sump is integrated into one corner of the impoundment area to create a deeper pool from which the pump can remove water. The sump is covered by an aluminum grate system to keep out large debris and for safety. The pump discharges into the existing storm drain system via overland flow.

13.34.1.8 Storm water drainage calculations

The peak rate of discharge to the impoundment for the 10-year, 1-hour event is 2,470 gpm (5.5 cfs). In compliance with NFPA 59A, twenty-five percent (25%) of the peak rate is 620 gpm.

The paved areas of the MFH Facility are designed for a 10-year storm per NOAA Atlas 14, Volume 3, Version 4; Station CATANO. Localized catch basins are provided at low-points, collecting a maximum of a 5,500 square-foot area.

13.34.1.9 Impoundment system snow and ice removal

This is not applicable for the MFH Facility.

13.34.1.10 Snow and ice load Basis of Design and removal

This is not applicable for the MFH Facility.

13.35 PASSIVE PROTECTION SYSTEMS

The MFH Facility uses Foamglas Gen-2 insulation blocks installed in the impoundment basin. The system provides passive protection thermal radiation hazards, in the event of an LNG spill that is collected in the impoundment basin.

Further information on the Foamglas system is included in appendix 13S4.

13.36 HAZARD DETECTION SYSTEMS

13.36.1 Hazard Detection System Design

The Fire & Gas Detection system, part of the SIS, is installed to detect and mitigate the occurrence of physical situations that could result in injury to personnel and/or damage to property and the environment. The fire and gas system accomplishes this by detecting and alerting operators to the presence of fire, LNG spills, flammable gas or cryogenic liquid leak hazards. Operators then take necessary actions to control and minimize the extent and severity of these hazards.

[redacted]

[redacted]

Further information is contained in appendix 13S.

13.36.1.1 Hazard detection philosophies (selection, layout, alarm, activation, and/or shutdown setpoints, voting logic, voting degradation logic)

Flammable gas detection and monitoring systems are installed throughout the MFH Facility. These systems will provide early detection of incipient fires and flammable gas leaks. Indoor and outdoor systems are intended to initiate operator and emergency personnel responses so that harm to the MFH Facility, its personnel, and the community may be averted and minimized.

[redacted]

13.36.1.2 Hazard detection design and performance criteria (e.g., minimum detector spacing, maximum detection time, etc.)

[redacted]

[redacted]

The design and performance criteria for the hazard detection design is contained in appendix 13S6.

13.36.1.3 Low temperature detectors

[redacted]

Refer to Hazard Detection Layout Drawings, provided in appendix 13S6 for details on the locations of low temperature detectors.

13.36.1.4 Oxygen deficiency detectors

This is not applicable for the MFH Facility.

13.36.1.5 Toxic gas detectors

This is not applicable for the MFH Facility.

13.36.1.6 Flammable/combustible gas detectors

The Gas Detection System is composed of point source gas detectors and line-of-sight gas detectors connected to the appropriate element of the FGS.

Refer to Hazard Detection Layout Drawings, provided in appendix 13S6 for details on the locations of flammable/combustible gas detectors.

13.36.1.7 Flame detectors

Flame detectors are provided in high leak potential equipment areas to monitor locations where release and subsequent ignition of hydrocarbons are credible.

Refer to Hazard Detection Layout Drawings, provided in appendix 13S6 for details on the locations of flame detectors.

13.36.1.8 Heat detectors

A single fixed temperature heat detector is provided in the control building.

Refer to Hazard Detection Layout Drawings, provided in appendix 13S6 for details on the locations of heat detectors.

13.36.1.9 Smoke/products of combustion detectors

Smoke detectors are addressable with an alarm LED for identification in the event of an alarm condition.

13.36.1.10 Manual pull stations

Manual alarm call points are provided in accessible areas throughout the plant for personnel to report the occurrence of an emergency condition.

Refer to Hazard Detection Layout Drawings, provided in appendix 13S6 for details on the locations of manual pull stations.

13.36.1.11 Audible and visual notification systems for field, control room, plant wide, and off-site

Fire alarm strobes, gas alarm strobes, PAGA speakers and PAGA beacons are provided in all plant areas. Strobes have distinct coloration to facilitate recognition of the type of hazard identified.

13.36.1.12 Other hazard detectors (e.g., rate of rise temperature detectors, acoustic leak detectors, CCTV detectors, carbon monoxide, etc.)

This is not applicable for the MFH Facility.

13.37 HAZARD CONTROL SYSTEMS

13.37.1 Hazard Control System Design

Dry chemical systems are effective against hydrocarbon pools and three-dimensional fires, particularly those involving spills or leaks when risk of re-ignition will be low. Potassium bicarbonate dry chemical is used in portable extinguishers, both handheld and wheeled. Extinguisher size depends on the type, location and size of the hazard, existence of nearby ignition sources, and the ability to access the hazard.

Portable CO2 extinguishers, complete with wall mounting brackets/cabinets, are provided in the Central control room, electrical and power substations, switchgear rooms, and other rooms/buildings where electrical hazards are present.

13.37.1.1 Hazard control philosophies (selection, layout, activation)

For hazard control equipment coverage, see equipment layouts detailed in section 13.37.1.3 and Hazard Control Safety equipment list, Document No. USAL-CB-FLZZZ-00-000007-000 included in appendix 13S.

13.37.1.2 Performance criteria (e.g., minimum flow and capacity, maximum travel distance/spacing, etc.)

Portable fire extinguishers are located throughout the MFH Facility and within all buildings. Extinguishers are located within 50 feet of the area to be protected.

Wheeled fire extinguishers in accordance with NFPA 10 are provided for use by personnel to extinguish outdoor moderate size fires.

The design and performance criteria for the hazard control design are contained in appendix 13S10.

13.37.1.3 Portable fire extinguishers design and layout with reference to drawings in appendix 13S

The portable and wheeled dry chemical equipment is located throughout the MFH Facility. Further information is contained appendix 13S10.

13.37.1.4 Fixed dry chemical systems design and layout with reference to drawings in appendix 13S

A fixed dry chemical skid is included in the safety design of the control building. Further information is contained in appendix 13S10.

13.37.1.5 Clean agent systems design and layout with reference to drawings in appendix 13S

A clean agent system is included in the safety design of the electrical building. Further information is contained in appendix 13S10.

13.37.1.6 Carbon dioxide systems design and layout with reference to drawings in appendix 13S

A standalone, piped carbon dioxide system is not included in the design of the MFH Facility; however, portable handheld CO2 extinguishers are provided in the electrical building.

13.37.1.7 Other hazard control systems (e.g., nitrogen snuffing, dispersive fans, building ventilation, etc.) design and layout with reference to drawings in appendix 13S

This is not applicable for the MFH Facility.

13.38 FIRE WATER SYSTEM

13.38.1 Fire Water Design

Firewater for the fire hydrants at the MFH Facility is supplied through a municipal connection to the city of San Juan, and specifically on-site through a combination of newly installed and existing water pipe. The existing 8-inch water main on-site was utilized, with new 4- and 3-inch piping connecting to the Operations Building and the pump house on the marine berth, respectively. The pump house is then connected to ship-to-shore connection and the monitors.

13.38.1.1 Fire water philosophy

Firewater is provided for exposure cooling and defensive fire-fighting operations. This public water supply will be used to supply the hydrants, a double-interlock pre-action sprinkler system in the Operations Building, and a Ship-to-Shore hose connection at the dock. A separate saltwater firewater supply in the form of a dedicated firewater pump is to be installed on the dock supplying 1,000 gpm at 130 psi. This pump will support two (2) 500 gpm self-oscillating monitors installed on the dock to be used for cooling water and exposure protection for equipment located on the dock.

The firewater philosophy is contained in the Fire Protection Evaluation included in appendix 13S1.

13.38.1.2 Fire water system design cases, demands, calculations, and basis of sizing

The fire water system is designed to deliver a total of 354 gpm with an end head pressure of 7 psig. Further information is contained in appendix 13S.

13.38.1.3 Main fire water supply and back up supply (e.g., fire water tank, pond, ocean, wells, city, etc.)

The main firewater supply for the fire hydrants at the MFH Facility is through a municipal connection to the city of San Juan. Firewater supply to the hose tower area is supplied via one electrical-driven seawater pump located on the marine berth. An emergency diesel generator is provided to supply power to the electrically-driven fire water pump in case of loss of permanent electrical power.

13.38.1.4 Fire water supply pressure, psig

City firewater is supplied at a flow rate of 560 gpm, at a supply pressure of approximately 40 psig.

13.38.1.5 Fire water storage type and capacity, gal

This is not applicable for the MFH Facility.

13.38.1.6 Main fire water pumps and driver type

[redacted]

13.38.1.7 Number of main fire water pumps, operating and standby

One 100% firewater pump is provided for operation; no pumps are available for standby. One operating Jockey Pump is provided.

13.38.1.8 Main fire water pumps operating and design flow rate capacities (minimum, rated, maximum), gpm

[redacted]

13.38.1.9 Main fire water pumps operating and design pressures (minimum, rated, maximum)

[redacted]

13.38.1.10 Jockey/make up water source

The jockey/make up water source for the MFH Facility is seawater from Puerto Nuevo.

13.38.1.11 Jockey/make up water operating and design flow rate capacities (minimum, rated, maximum), gpm

[redacted]

13.38.1.12 Jockey/make up water operating and design pressures (minimum, rated, maximum), psig

[redacted]

13.38.1.13 Fire water piping design and layout with reference to drawings in appendix 13S

The firewater piping design and layout is contained in appendix 13S.

Freeze protection (burial depth below frost depth, aboveground heat tracing, etc.)

This is not applicable for the MFH Facility.

13.38.1.14 Fire water hydrants design and layout with reference to drawings in appendix 13S

The firewater piping design and layout is contained in appendix 13S10.

13.38.1.15 Fire water monitors design and layout with reference to drawings in appendix 13S

The firewater piping design and layout is contained in appendix 13S10.

13.38.1.16 Hose reels design and layout with reference to drawings in appendix 13S

The firewater piping design and layout is contained in appendix 13S10

13.38.1.17 Water screens and deluge systems design and layout with reference to drawings in appendix 13S

A water screen is utilized on the FSU during any ship-to-shore transfer operations to protect the hull area. The screen uses seawater sourced from Puerto Nuevo and pumped via the ship pumps.

13.38.1.18 Expansion foam philosophy

This is not applicable for the MFH Facility.

13.38.1.19 Expansion foam system design cases, demands, calculations, and basis of sizing

This is not applicable for the MFH Facility.

13.38.1.20 Expansion foam water supply

This is not applicable for the MFH Facility.

13.38.1.21 Expansion foam supply

This is not applicable for the MFH Facility.

13.38.1.22 Expansion foam type (e.g. low expansion Aqueous Film-Forming Foam [AFFF], high expansion foam, etc.)

This is not applicable for the MFH Facility.

13.38.1.23 Expansion foam concentration, percent volume

This is not applicable for the MFH Facility.

13.38.1.24 Expansion foam storage type and capacity, gal

This is not applicable for the MFH Facility.

13.38.1.25 Expansion foam pumps and driver type

This is not applicable for the MFH Facility.

13.38.1.26 Number of expansion foam pumps, operating and standby

This is not applicable for the MFH Facility.

13.38.1.27 Expansion foam pumps operating and design flow rate capacities (minimum, rated, maximum), gpm

This is not applicable for the MFH Facility.

13.38.1.28 Expansion foam pumps operating and design pressures (minimum, rated, maximum)

This is not applicable for the MFH Facility.

13.38.1.29 Expansion foam piping design and layout with reference to drawings in appendix 13S

This is not applicable for the MFH Facility.

13.38.1.30 Expansion foam generators design and layout with reference to drawings in appendix 13S

This is not applicable for the MFH Facility.

13.38.1.31 Expansion foam hose reels design and layout with reference to drawings in appendix 13S

This is not applicable for the MFH Facility.

13.38.1.32 External impact protection (bollards)

Bollards will be provided around fire protection equipment to protect from vehicle traffic.

13.39 EMERGENCY RESPONSE PLAN

13.39.1 Emergency Response Plan

An Emergency Response Plan ("ERP") was developed by NFEnergía to establish the procedures for responding to emergencies that may occur at the MFH Facility.

The ERP is used to facilitate and organize the MFH Facility personnel's actions during an emergency that may occur within the MFH Facility and includes certain emergencies that occur outside the MFH Facility, which could have an impact on MFH Facility operations, MFH Facility personnel or neighboring facilities and activities.

The ERP provides response guidance and the minimum employee training requirements for MFH Facility personnel, such that employees understand their roles and responsibilities within the Plan and defines the actions that employees should take in the event of an emergency.

Implementation of the ERP should result in the minimization of injuries, damage to equipment and structures within the confines of the MFH Facility, the surrounding infrastructure, the environment, and interruption of business continuity.

13.39.1.1 Incident Command System organizational chart for emergency response

The MFH Facility has established an incident command system to effectively manage an emergency response as part of the ERP. The incident command system is comprised of key personnel who are assigned to perform specific functions within the incident command structure. Further information is contained in appendix 11C.

13.39.1.2 Proximity of emergency response, fire brigades/departments, mutual aid, and local law enforcement

Fire and emergency services are located within two miles of the MFH Facility, with local law enforcement located within four miles. United States Coast Guard Sector San Juan is located within 8 miles of the MFH Facility. Further information on the procedures for MFH Facility personnel to follow is contained in appendix 11C.

13.39.1.3 Number of emergency response personnel

The MFH Facility employees are responsible for providing the initial response to contain an emergency. As such, all employees are trained in basic LNG firefighting procedures and LNG properties and hazards. This includes the detailed list of responsibilities contained in the ERP in appendix 11C.

13.39.1.4 Number and type of emergency response apparatus

This is not applicable for the MFH Facility.

13.39.1.5 Response to emergencies and deployment of resources

The MFH Facility has a designated Emergency Response Coordinator, who is responsible for overseeing the implementation of the planning and response to emergencies. The responsibilities include providing sufficient resources and trained personnel to address emergency requirements, directing and coordinating personnel and operations, and communicating with local emergency response departments and authorities. The specific procedures for emergency response and deployment of resources are detailed in appendix 11C.

13.39.1.6 Public and on-site notification and communication

Emergencies will be reported by field personnel via two-way radio to notify local operations. Emergency traffic will take priority over all radio traffic.

Communication to stakeholders within the port area will be coordinated between NFE, the USCG and the Port Authority of San Juan. Notifications outside of the port area will be managed in coordination with the local jurisdictional authorities and will be carried out through existing systems (e.g., outdoor warning sirens, Emergency Broadcast System (EBS), etc.).

Additional information is provided in appendix 11C.

13.39.1.7 Multiple access and egress locations and roadways, internal and external to site

The MFH Facility has two egress locations from the site, one at the main MFH Facility entrance to the west, and one on the east side of the MFH Facility. Further information is contained in appendix 11C.

13.39.1.8 Preliminary evacuation routes within and adjacent to plant and LNG vessel route

In the event of an emergency occurring within the MFH Facility requiring an evacuation of the Facility, the incident commander will direct site personnel to report to the designated Muster Points and Egress Locations. Site maps are strategically placed throughout the Facility and contain the muster point locations and evacuation routes for the Facility.

Additional information is provided in section 11C.

13.39.1.9 Proposed frequency and type of security and emergency response training and drills for on-site personnel and emergency responders

MFH Facility personnel are trained on an annual basis, or whenever there are significant changes to the ERP. Further information is contained in appendix 11C.

13.39.1.10 Contact and communications with the Coast Guard, including Letter of Intent and submittal of preliminary Waterway Suitability Assessment (at time of pre-filing), and submittal of a Follow-on Waterway Suitability Assessment (at time of application)

The ERP for the MFH Facility details the emergency contacts and communication protocols with the Coast Guard. A copy is provided in appendix 11C.

13.39.1.11 Contact and communications with the State Fire Marshal

The ERP for the MFH Facility details the necessary contacts and communication protocols with the Fire Marshal. A copy is provided in appendix 11C.

13.39.1.12 Contacts and communications with all other appropriate agencies

The ERP for the MFH Facility details the necessary contacts and communication protocols with all other appropriate agencies. A copy is provided in appendix 11C.

13.39.1.13 Preliminary Cost-Sharing Plans with any state and local agencies and responders to fund security, emergency management, and training costs

This is not applicable for the MFH Facility.

13.39.1.14 Schedule for any future actions, studies or meetings to develop the ERP and Cost-Sharing Plan

The MFH Facility is currently operating and a copy of the ERP is provided in appendix 11C. To support development of the Cost-Sharing Plan, NFEnergía has been engaged in preliminary discussions with the San Juan Fire Department since 2018, the most recent meeting having occurred on August 12, 2021. NFEnergía is continuing to work with the Department to develop the Cost-Sharing Plan; the proposed agreement will include annual monetary contributions by NFEnergía to the San Juan Fire Department and the Puerto Rico Volunteer Fire Department, specifically donations of equipment, access to equipment, and coordination of training facilities. NFEnergía has also been offered participation in the mutual-aid response committee for the Port of San Juan.